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An All-Gas Restaurant

By

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and

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THE "All-Gas" Home, using gas for the "Big Four"—cooking, refrigeration, water heating and central heating—is today a commonplace, but an All-Gas restaurant using gas exclusively for the same Big Four merits attention.

Such a restaurant is that of Charles Aprile, located at 1551 Mt. Hope Avenue, Rochester, N. Y. This recently opened restaurant embodies all the desirable features contributing to better food and better service that Mr. Aprile has discovered in an experience of operating lunch rooms that extends back over a number of years. Every item, from coffee urns to deep fat frier, from water heater to dish washer, from refrigerator to central heating, is gas-fired. This was in direct accord with Mr. Aprile's own wishes.

The building itself, designed by and built for its present occupant, is a one-story building with a full basement. Side walls and ceiling consist of vari-colored panels of insulating board, serving the double purpose of decoration and insulation. Windows are of casement type steel sash protected in the Winter by storm sash. A vestibule gives added protection.

The kitchen runs across the entire rear of the building with a loudspeaker giving rapid communication from dining room to the chef. A U-shaped counter seating 12 takes up the better part of the right hand side of the restaurant proper. Along the rear wall close to this counter are placed the coffee urns and the barbecue steam table. Tables are located in the left-hand half and around the outside walls, seating an additional 38 people.

The building itself is located on a main highway at the edge of the city, not far from Strong Memorial Hospital. It thus enjoys a most cosmopolitan trade, being open 24 hours a day—tourists and truck drivers, nurses and internes, all rubbing elbows and enjoying equally the most appetizing of food served under the best of conditions.

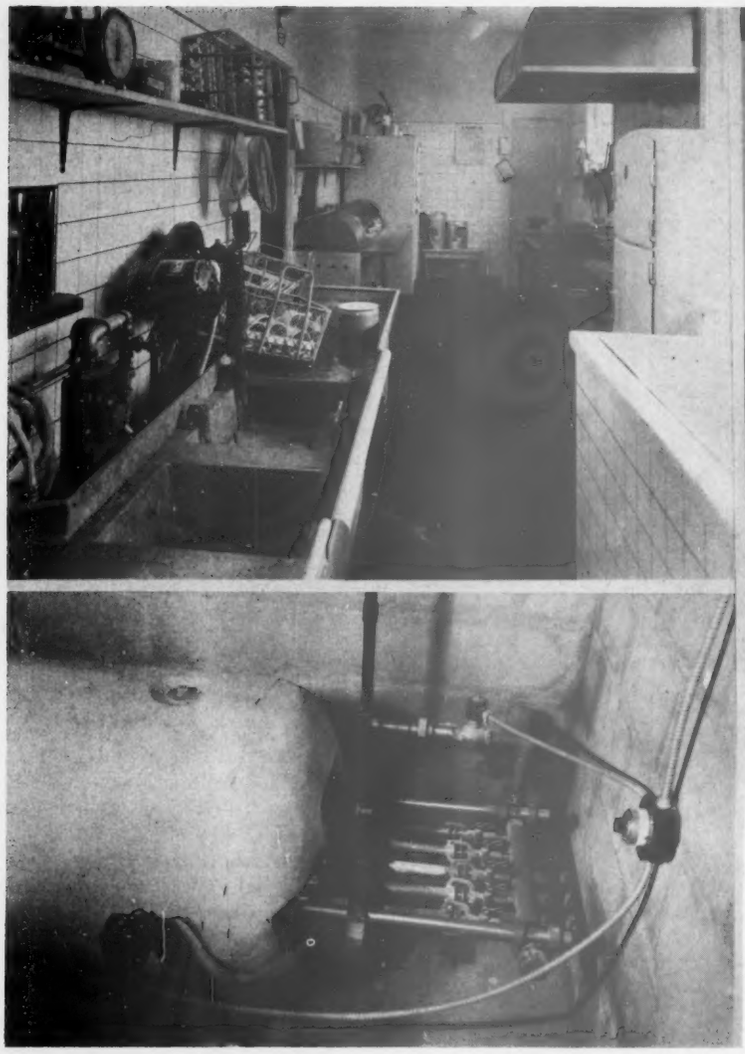
Cleanliness is usually taken for granted in a restaurant (sometimes, it must be confessed, mistakenly so), but in this particular case it forms the very backbone of Mr. Aprile's code. His previous places were always immaculate and led to his insistence on all-gas for the latest. The basement and the kitchen, although not visible to the casual customer, are just as spotless as the main dining room, one reason probably why this restaurant is in such favor with the internes and nurses from the nearby hospital.

Taking up his equipment and starting in the basement, the central heating unit is a Bryant 85-A-88 Air Conditioning furnace, with an 85,000 Btu input and an air delivery of 850 cubic feet per minute. A rectangular trunk system with round branches leads to 10 warm air registers inconspicuously located.

Three cold air return grilles placed in the proper locations bring the cold air back to the furnace where it is filtered, heated, and humidified. A very even, comfortable temperature is maintained in the Winter months with the circulation of air acting to remove any smoke or odors leaving a clear, pure atmosphere. In the Summer the same circulation contributes towards a cooler room. From every angle the heating plant has proven itself a success. Costs are very reasonable as shown below, and the customers are well pleased with the results.

In the basement is also located the water heater. This is a Sellers heater of the horizontal immersion tube type. The tank has a capacity of 102 gallons and has six 1¼" alloy steel tubes running the sixfoot length of the 20" diameter tank. A special atmospheric type gas burner fires into each tube, the total input being 64,000 Btu per hour, giving a recovery of 102 gallons an hour over a 60° F. temperature rise. An aquastat of the mercury switch type and a solenoid valve on the gas line give complete control of the desired water temperature. A thermostatic pilot safeguards pilot ignition. The immersion principle of heating gives an exceptionally high efficiency with over 80% being guaranteed by the manufacturer. Any lime or mud in the water settles out below the tubes and is removed, thus contributing to the extremely long life of this type of heater and to its service-free nature.

Going upstairs to the kitchen we find at one end a No. 652J Electrolux unit connected to a 30 cubic foot box.



Above: Garland Range and Pitco Frialator.

Lower Left: Sellers Horizontal Immersion Water Heater showing burner equipment safety pilot and solenoid gas valve.

Top Left: General kitchen view shows Dish Washer in left foreground, Steam Table just beyond, Electrolux in rear, Range and Frialator at right.

All the advantages of gas refrigeration, now so well known, are provided by this commercial Elextrolux installation—complete quietness in operation, freedom from mechanical wear and tear, the elimination of service, and economy of cost. This is a new type of gas appliance for Mr. Aprile, but one in which he takes considerable pride and which has more than justified the confidence he placed in this latest contribution of the gas industry.

At one side of the kitchen is a No. 9460CCX Garland junior restaurant range which has a combination griddle, broiler and toaster with two-thirds closed top and one-third open top and two big capacity ovens that are built for heavy service. Each oven is heated by an efficient powerful burner of special design. Accurate oven heat controls automatically maintain ovens at desired temperatures and give fuel economy. Ovens are insulated with 1½" thickness of high quality insulation that helps to keep kitchen cooler and also reduces fuel consumption. The oven linings are finished in porcelain enamel for easy cleaning.

Next to the range is a No. 10 Pitco Frialator used for deep fat frying. This likewise is automatically controlled and in a minumum of floor space turns out a maximum of production. This type of deep fat frier makes possible the cooking of a variety of foods without any one affecting the taste of the next. It also gives a saving in grease more than adequate to pay for itself. The golden brown French fried potatoes so much in demand here are ample proof of its ability.

On the opposite side of the kitchen there is an 8′ steam table, gas heated, for holding food at serving temperature.

There is also a Feerless dishwasher heated by gas burners, thermostaticaly controlled, for maintaining the desired temperature of the hot water. In this type of dishwasher, the dishes are held in a cradle that moves back and forth in the water. This leads to a considerable churning motion which it is claimed accomplishes a greater amount of cleaning with the expenditure of smaller quantities of water. In any case, the dishes and silver do emerge spotlessly clean and sterilized.

Going now into the dining room, behind the U-shaped counter and easily accessible to the staff, there is found a gas-heated double Amcoin coffee urn, also thermostatically controlled. Beneath the urns is a cup warmer compartment, likewise gas heated. A barbecue steam table just beyond the coffee urns completes the list of gas equipment.

This list of gas burning appliances is quite impressive and certainly complete. Perhaps the question arises as to operating cost. It so happens that Rochester has a 540 Btu manufactured gas selling at conventional city gas prices. Yet for the period of one month from January 1939 to February 1939 the cost of all gas exclusive of that for central heating was but $72.00. This covers 24-hour operation and the serving of some 9,000 meals. The cost of gas for central heating was $16.00 for the same period, the coldest of the Winter, and argues well for a total cost well under the estimate for the season given Mr. Aprile by the engineers of the House Heating Department of the Rochester Gas & Electric Corporation.

The Effects of Cyanogen on The Manufactured Gas Industry

By

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I HAVE been asked by your Chairman to present a paper before this meeting on the subject of cyanogen and its effects on the manufactured gas industry. May I say at the beginning that I do not pretend to know all of the answers. Anyone who has had the opportunity to make a study of cyanogen will know that it is very complex and capable of entering into many kinds of reactions. Despite this I believe we can discuss the subject in the light of present day experience. That is the intended purpose of this paper.

Considerable interest has been shown of late in cyanogen or, as it is generally conceded to exist, hydrocyanic acid (HCN). Although known to have existed in manufactured gas for a long time, it is only within recent years that cyanogen has become associated with the corrosion of production and distribution equipment, with the appliance stoppage problem and as a factor in connection with certain difficulties arising in the purification of gas.

Previous Investigations

As the literature will reveal, cyanogen has been recognized as a factor in the corrosion process. McLeod[1] in England, more than 25 years ago, was aware of its action in this respect. Kersting[2] in reporting on rust deposits in mains and services was probably the first in this country to mention cyanogen as an outstanding corrosion element. Taplay[3] classified six agencies in the order of their destructive properties, placing hydrocyanic acid at the head of the list. However, Richardson[4] believed that its injurious effects were exaggerated. Still he believed in removing cyanogen as much as possible because it assisted in increasing corrosion. Hicks[5] concluded that cyanogen as hydrocyanic acid cannot initiate corrosion. Rather it is contributory in its effects. This same investigator made a detailed study of an internal corrosion situation[6] in the Portland, Oregon, distribution system. He found the principal disturbing agent to be hydrocyanic acid with carbonic acid and oxygen contributing to a lesser extent.

I have appended a bibliography to this paper which deals with effects on mains, meters, holders and purifier boxes.

Role of Cyanogen in Corrosion Process

As to the part played by cyanogen in the corrosion process, there has been much varying opinion. But I think it can be generally stated that it does not initiate trouble but it contributes to a condition indirectly.

Regardless of explanations as to the mechanism of corrosion or the intermediate steps involved, Prussian blue or ferri-ferro cyanide is found as an end-product. The presence of moisture is a prime necessity as in any other situation where this type of corrosion occurs. For all practical purposes the following reactions represent the mechanism involved.

$$1\text{—}FeO + 2\ HCN \rightarrow Fe(CN)_2 + H_2O$$

$$2\text{—}18\ Fe(CN)_2 + 3O_2 \rightarrow 2\ Fe_4[Fe(CN)_6]_3 + 2\ Fe_2O_3$$

(Prussian blue)

It will be noted that a ferrous condition is demanded before the hydrocyanic acid is fixed. Ferric oxide or hydroxide do not enter into a reaction.

Needle-Valve Stoppages

The stoppage problem up to very recently considered two types of substances as causes of deposits on the needle valves of various appliances. These substances are known as liquid and vapor phase gums. In 1937 before the Joint Committee Conference of the Production and Chemical Committees, American Gas Association, your speaker, in collaboration with A. R. Bayer, showed how cyanogen combined with certain forms of organic sulphur to corrode copper and brass and tended to add to the stoppage problem.

Like many others, my company had been troubled with stoppages on needle valves in the various kinds of appliances, but particularly on the by-passes of refrigerators and to some extent on ranges. While most of the condition was due to liquid phase gum there were a number of complaints due supposedly to vapor phase gum. However, the nitric oxide content of the gas leaving the holders was never found in excess of 0.3 of a gram per million cubic feet of gas. Since nitric oxide is the primary cause of vapor phase gum there seemed to be justification for the belief that these stoppages were due to factors other than the ones already known. It was during the course of a certain investigation that a clue was discovered regarding the part played by cyanogen and organic sulphur in causing deposits on needle valves.

Gas containing 4.7 grains per 100 cu. ft. of organic sulphur, 0.4 of a grain of hydrocyanic acid was passed into a copper tubing causing it to bubble through water contained in a jar. After a short space of time, it was noticed that the copper became coated with a heavy tarnish. As the rate of tarnish progressed, a brownish green substance deposited at the bottom of the jar. Analysis of this deposit showed a definite product of corrosion composed of a complex arrangement of copper, mercaptans (organic sulphur) and hydrocyanic acid. Parallel experiments with iron pipe produced similar results, although the reaction was much slower. Aluminum tubing gave no deposits of any kind. A significant point about the copper and iron deposits was their action with Griess reagent. On heating in air both substances yielded nitrogen peroxide acting in the same manner as vapor phase does under the same treatment.

** Paper presented at New England Gas Association, Operating Division, held at Providence, R. I., Nov. 3, 1938.*

Table I shows a comparison of tarnish effects produced on the metals.

TABLE 1
Rate of Gas—5 c.f. Per Hour

Metal	*Cu. ft. Gas Passed before Showing Evidence of Tarnish*
Copper	1152
Iron	3188
Aluminum	No Tarnish After 21,000

These new corrosion products seemed important enough to warrant a more extended study. This we decided to do by the use of synthetic materials. Various forms of organic sulphur were individually bubbled with hydrocyanic acid gas through copper and iron tubing, the same conditions being held as in the previous experiments. Since synthesis was the primary object, no effort was made at quantitative measurements. From the results of this work we obtained a series of reaction rates with various components as shown in Table II.

More conclusive evidence regarding the action of organic sulphur and cyanogen was obtained by the preparation of the silver salts. This combination was selected because of its greater reactivity and for the reason that photomicrographs were more easily obtainable. Figure 1 shows a synthetic preparation of pure silver mercaptide, while Figure 2 is a mixture of pure silver cyanide and silver nitrite. In Figure 3 we get the results from a sample of pipe deposit indicating the presence of mercaptans and cyanogen. Silver nitrite is a decomposition end product brought about on heating the mixture and is the constituent that reacts with Griess reagent. Figure 4 shows the same result in connection with a needle valve deposit.

TABLE II

Relative Reaction Rates
Organic Sulphur + Hydrocyanic Acid (HCN) + Copper

Organic S Form	*Formula*	*Relative Reaction Ratio*
Ethyl Mercaptan	C_2H_5SH	100.0
Diethyl Sulphide	$(C_2H_5)_2S$	40.0
Phenyl Mercaptan	C_6H_5SH	11.1
Diphenyl Sulphide	$(C_6H_5)_2S$	4.7
Carbon Disulphide	CS_2	3.9

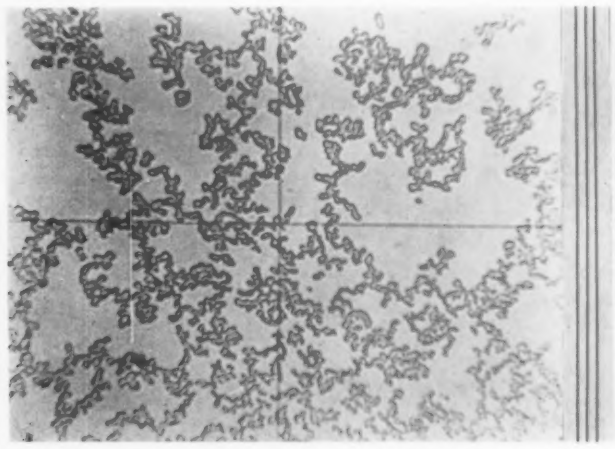


Figure 1—Pure silver mercaptide. Silver nitrate hanging drop method 440X.

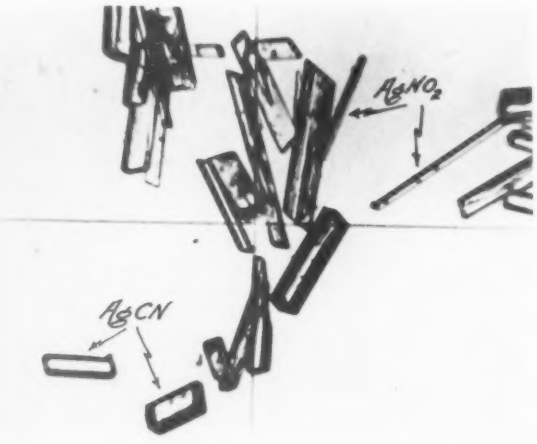


Figure 2—Pure silver cyanide and silver nitrite. Silver nitrate hanging drop method 440X.

As indicated in the table, ethyl mercaptan was found to be the most reactive form of organic sulphur in its effect on copper when combined with hydrocyanic acid. At the same time, reaction with Griess reagent was positive in all cases showing, at least in this situation, the possibility of mistaking these substances for vapor phase gum. Under the same experimental condition carbon disulphide is indicated to be about 25 times less reactive than ethyl mercaptan. If carbon disulphide represented the total sulphur in a manufactured gas there should be little trouble with respect to corrosion deposits on needle valves. In general, it can be said that the aromatic forms of organic sulphur are less susceptible to combination with cyanogen and copper than are those contained in the aliphatic series.

All forms of organic sulphur mentioned in Table II are found in manufactured gas. The mixed product distributed by The Brooklyn Union Gas Company contains organic sulphur, 80% of which consists of mercaptans, the remainder being carbon disulphide and all other forms combined. The probable reason for this is the presence of refinery gas.

With the theoretical knowledge obtained it now became necessary to correlate this work by practical data. For this purpose about 400 needle valves of various metals were collected from the district. Each of these specimens represented a service complaint due to a too low burning pilot or a complete outage. Out of the total number of needles, 240 were made of brass, 123 from steel, 16 from aluminum and 23 from chrome plated steel. Inspection revealed that practically all of the brass needles contained a deposit whose principal component was the organic sulphur—cyanogen complex, while deposits on all other types of needles were 100% liquid phase gum. Only in a very few instances was the complex found on steel needles, which would be as expected in the light of the theory regarding copper and iron (likewise their alloys) as base exchanges in city gas corrosion.

Furthering the search for practical information, the results of a recent survey made in connection with pilot outages on ranges were classified as to metals and type of complaint and are given in Table III.

TABLE III
Survey of Needle Valve Complaints

Metal	*Pilot Out*	*Pilot Too Low*
Brass	516	169
Steel	47	140
Aluminum	4	23
Steel Chrome Plated	2	14

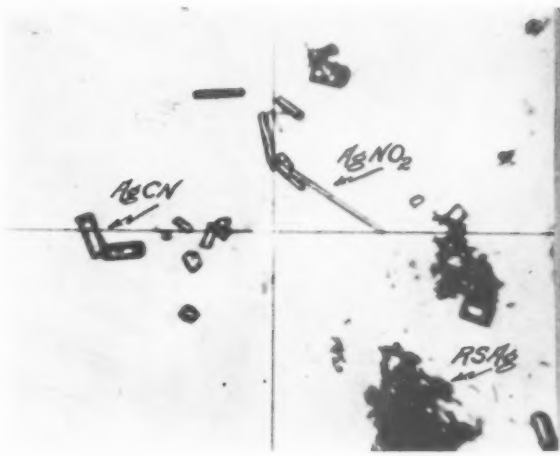


Figure 3—Mixture of silver cyanide, silver nitrite and silver mercaptide. Sample from pipe deposit 440X.

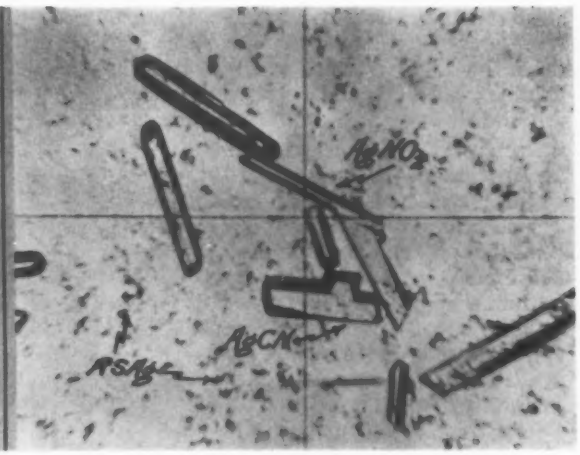


Figure 4—Mixture of silver cyanide, silver nitrite and silver mercaptide. Sample from a pilot needle-valve.

As far as could be determined the number of brass and steel needle valves on the district was very nearly the same. However, in the case of pilot outages the brass valves were 11 times as susceptible to stoppage as were the steel valves.

Effects on Dry Purification Systems

As far as corrosion of purifier boxes by hydrocyanic acid is concerned, this writer has had but little experience. Information in this respect seems rather meagre. Corrosion does occur in the boxes and it is the usual practice to paint affected areas for protection. The maintenance of proper alkalinity of the oxide moisture appears to lessen the need for paint protection against corrosion caused by the normal acid conditions.

The removal of hydrogen sulphide by iron oxide can be seriously hampered by the improper fixing of hydrocyanic acid. It is a well established fact that box acidity retards the absorption of both cyanogen and hydrogen sulphide, allowing the cyanogen to pass out into the gas stream to the transmission and distribution systems. The formation of acid conditions within the iron oxide mass probably begins with the normal sulphiding and revivification reactions. As time proceeds, ferrous sulphide, an acid product, combines with hydrocyanic acid to form ferrous cyanide. In turn, the latter reacts with free sulphur to form ferrous thiocyanate. The following reactions serve to illustrate the mechanism.

$$FeO + H_2S \rightarrow FeS + H_2O$$
$$2\ FeS + O_2 \rightarrow 2\ FeO + 2\ S$$
$$2\ FeS + 4\ HCN \rightarrow 2\ Fe(CN)_2 + 2\ H_2S$$
$$2\ Fe(CN)_2 + 4\ S \rightarrow 2\ Fe(SCN)_2$$

Ferrous thiocyanate shown as the end product is a strong acid when in solution and is capable of creating purification difficulties if not held in check. It is the reason for the existence of low pH values of drain water issuing from the boxes. Incidentally, ferrous thiocyanate, when allowed to accumulate, has been known to completely dissolve iron oxide from wood shavings.

Ammonia, now being used in many plants to maintain alkalinity in boxes, may in itself produce highly acid conditions when used to excess. According to Avery[7] this acidity is produced indirectly by a series of reactions as given below. The ammonia first reacts with hydrocyanic acid, and together with sulphur always present in partially spent oxide, forms ammonium thiocyanate. This thiocyanate can further react with ferrous sulphide or ferrous oxide forming ferrous thiocyanate.

$$NH_3 + HCN + S \rightarrow NH_4CNS$$
$$2\ NH_4CNS + FeS \rightarrow Fe(CNS)_2 + 2\ NH_3 + H_2S$$
$$2\ NH_4CNS + FeO \rightarrow Fe(CNS)_2 + 2\ NH_3 + H_2O$$

Experience has shown that an iron oxide mass becomes rapidly acid after a short period of time even though ample proportions of alkali were present before use. Drain water samples from boxes, especially in first position, although showing a pH value of 7.5 to 8.0 for the first few days of operation, would quickly descend to values well within the acid range or about pH 5.0. There would of course be some initial difference in the change from alkaline to acid range depending on the type of oxide used. However, no purification material is known that will remain sufficiently alkaline without assistance from outside sources.

Examination of many drain waters, particularly from first box positions, revealed some interesting facts regarding thiocyanates. Amounts varying from a few hundred grains to several thousand grains per gallon were found. The significant thing about these high concentrations of thiocyanates was that they did not necessarily represent an index of purification difficulties, unless the pH value fell below 7.0. As acidity increased, indicated by decreasing pH values, more and more soluble iron salts in the form of ferrous thiocyanate appeared. A drain water with a pH of 5.0 always showed considerable ferrous thiocyanate. Practically, all of the thiocyanate content of drain waters with pH values of 7.0 or above appeared mainly as the ammonium compound. Under the conditions surrounding purifier operations, these salts can be rendered harmless from the standpoint of retarding purifier reactions. Also ammonium thiocyanate out of contact with air should not be the cause of corrosion. These statements are made on the assumption that only normal quantities of ammonia are entering the boxes at all times.

The expression "pH value" has been in use in the manufactured gas industry for several years so that no discussion of it seems necessary at this time other than to say that it represents a scale to denote the intensity of acidity or alkalinity. pH 7.0 is called the neutral point. Values above this point are in the alkaline range while those below 7.0 indicate acidity. The writer read a paper before the Joint Committee Confer-

ence of the Production and Chemical Committees of the American Gas Association in 1935 to which reference can be made for details concerning pH values.

The formation of Prussian blue (ferri-ferro cyanide) is another end product to be expected when an oxide becomes acid. The reactions involved in the process are not easy to explain but under suitable conditions, they are probably the result of the oxidation of ferrous cyanide. It has been stated that moisture or the admission of steam to the boxes aids in the formation of Prussian blue while a trace of ammonia in the gas will prevent it. This function of moisture has not been definitely proven but the value of ammonia as a preventative can be demonstrated. It is interesting in this connection to note that lime does not give the same effect. The conversion of ferrous thiocyanate to Prussian blue can be accomplished, although with some difficulty. Such a change is more likely to occur during revivification outside of the boxes.

Prussian blue, if formed to any great extent, coats the iron oxide mass and exerts an effect greater in proportion than the actual extent in which it is present. However, it does not appear to be as detrimental in retarding the removal of hydrogen sulphide as is the presence of undue amounts of ferrous thiocyanate.

Removal of Cyanogen

Where cyanogen is removed by liquid purification systems using an alkaline medium, the problem is comparatively simple. With this type of purifier, better than 90% removal can be expected. The residual cyanogen is then generally handled by dry purifiers as catch boxes resulting in a completely cyanogen-free gas.

Dry purification systems having adequate capacity for the normal function of removing hydrogen sulphide can be made to absorb cyanogen as well, provided certain conditions are maintained. The regulation of certain essential factors are necessary if the reduction of the cyanogen content is to be attained without undue sacrifice of hydrogen sulphide removal. It is well known that ferrous sulphide or ferrous oxide must be present before cyanogen reactions are possible. This fact, together with controlled amounts of moisture, oxygen (air), and alkalinity serves to suppress the tendency toward acidity within the purification mass.

Both research and experience have indicated that a moistened oxide is much more reactive to hydrocyanic acid than one in a dried out condition. There are, of course, limitations as to the amount of moisture that can be used. Excessive quantities, while possibly momentarily assisting cyanogen removal, would certainly delay reactions affecting hydrogen sulphide. Initially, most oxides contain 35 to 40% of water. Continued use brings gradually increasing dryness, especially in first box position, and to a lesser extent in the second box. This is natural since the bulk of reactions, exothermic in nature, occur here.

To maintain satisfactory moisture conditions in the oxide is not a simple matter. Difficulties in this connection can be greatly minimized if the oxide is never allowed to become so dry that it cannot be easily rewetted. This is important and failure to recognize the effect at the beginning of operations will lead to trouble. The same precaution, with respect to dried oxide, is necessary during revivification periods outside the boxes.

The matter of adding moisture to the boxes to make up for deficiencies has been more or less developed to a choice of two methods. One way uses sprays located under the box covers, by means of which controlled quantities of water are added to the oxide. Addition of water continues until it begins to flow freely from the drain lines. The injection of wet steam into the crude gas some distance ahead of the purifiers is also practiced as a means of introducing moisture. Both methods have their advantages and disadvantages. Nevertheless, both seem to serve the purpose in helping to minimize the problem of parched oxide.

The oxygen (air) content of the gas may be said to have an indirect influence on cyanogen removal. If used in excess of requirements, the revivification reactions are intensified, causing abnormal temperature rises and consequent drying out of the oxide. This is particularly so in the case of coal or coke oven gas purification.

The necessity of maintaining an alkaline purification material where cyanogen is concerned has been well established both in this country and abroad. The practice of adding a few grains of ammonia per 100 cu. ft. of crude gas has been shown to give definite results. Coke oven gas with its much higher cyanogen content requires somewhat more ammonia than carburetted water gas. However, no advantage can be found in using much more than 6 grains per 100 cu. ft. under any conditions.

The practice of using heavy "shots" of ammonia from time to time might lead to serious complications and should be condemned. As indicated above too much ammonia might defeat the objective by actually producing acid conditions.

Other necessary conditions being favorable, controlling the pH value of drain water just above 7.0 is all that is required to obtain the efficient removal of cyanogen. In several years operation of the purification plants at The Brooklyn Union Gas Company, the cyanogen content of the gas has been generally around 1 grain per 100 cu. ft. Obtaining samples of drain water after the water spraying seems to give values fairly representative of conditions of alkalinity within the boxes. It is of interest to note that quite recently Jaworski and Eyemann[8] reached the conclusion that ammonia additions must be regulated so as to obtain drain water with a pH value under 7.5. Higher values, these investigators claim, will result in hydrogen sulphide being liberated, particularly from the last box.

An interesting development in the control of cyanogen effects has been reported by Larson.[10] The Portland (Oregon) Gas and Coke Company had a dust problem caused by internal corrosion of mains. The principal agent was found to be hydrocyanic acid with carbon dioxide and oxygen contributing to a lesser extent. Complete elimination of these substances was not feasible from an economic standpoint but experiments indicated that dehydration of the gas would show a substantial reduction in internal corrosion. Under the existing circumstances, it was found that dehydration could be accomplished by compression and cooling, and now after three years' experience, conditions appear to be distinctly favorable. It is believed to be only a matter of time before the dust problem, except for pilot troubles, will become relatively unimportant.

Limits of Cyanogen

The question as to how much cyanogen can remain in the gas without producing adverse effects is an important one. The corrosion of mains, services, meters, etc., can be recognized by the presence of Prussian blue and ferric oxide, but the concentration of hydrocyanic acid in the gas necessary to create a problem would seem to be dependent upon the

presence or absence of certain conditions. The existence of an oily film on the metal surfaces, dehydration and the partial pressure of oxygen would influence the presence or absence of corrosion where cyanogen is involved.

Some ideas as to what is taking place within a main in regard to cyanogen corrosion may be found by an examination of the condensation from street drips. The pH value of the water, together with the soluble iron content, fixed or free ammonia and thiocyanates will provide information as to corrosion progress. It has been invariably found that if pH values of the drip water are much lower than 6.0, ferrous thiocyanate will be present in sufficient amount to indicate corrosion. This kind of a condition is the forerunner of dust trouble. When pH values are found around 7.0 thiocyanates still may be found but in the form of the ammonium salt. However, soluble iron is absent or at least in such small amounts as to be unimportant. A survey of conditions existing in selected drips in a territory might prove interesting where corrosion of mains is suspected. It is evident that if troubles are prevented in the mains there should be no problem of this nature with services and meters.

The cyanogen content of the gas where the organic sulphur cyanogen copper complex is concerned can be serious, even with very low concentrations. The investigations referred to at The Brooklyn Union Gas Company were carried on with a cyanogen content of only .4 of a grain per 100 cu. ft., this being sufficient to create corrosion stoppages on brass needle valves. One qualifying condition must be observed however. The fact that the organic sulphur of the gas was predominantly mercaptans accounted to a large extent for the corrosion effects produced. If carbon disulphide had been the chief constituent of organic sulphur, it is quite possible that higher concentrations of cyanogen would not have caused any difficulty. There is some evidence to indicate that 2 grains of hydrocyanic acid may be present in the gas provided there is little or no mercaptan, especially ethyl mercaptan. It must be remembered that this situation may not necessarily apply where Prussian blue corrosion is concerned.

It would seem that the elimination of hydrocyanic acid from the gas is a matter of existing circumstances and economics. With liquid purification and the attendant dry catch boxes at hand there should be no difficulty in entirely eliminating cyanogen. With dry purification systems, much will depend upon the condition of the oxide and capacity.

Determination of Hydrocyanic Acid in Gas

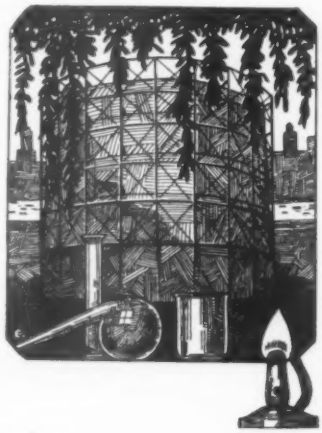
Modified Iso-Purpuric Acid Method for Determining HCN in Manufactured Gas

Apparatus:

4 Nessler comparator tubes, 100 c.c.; tall; stand.
3 Burettes, 25 c.c.
2 Bubbling bottles, 125 c.c.
1 Mohr pipette, 10 c.c.
1 Mohr pipette, 5 c.c.
1 Drying tower with cotton plug, small.
1 Wet meter.

Reagents:

100 c.c. of 15% KOH Solution.
Standard HCN solution, 100 ppm (100 ppm HCN = 0.1205 g. KCN per 0.5 liter)
Normal HCl.
Saturated picric acid solution.
5% Na_2CO_3 solution.
Dry Pb $(OH)_2$.2 $PbCO_3$, powdered.



Procedure:

Place both bubbling bottles, each containing 50 c.c. of 15% KOH solution, in series after a drying tower containing four ¼ inch layers of powdered white lead. The layers should be separated by cotton plugs to eliminate any unduly high back pressure or channelling action. The train is completed with a wet meter and outlet Bunsen burner.

For quantities of HCN greater than 1.0 grain per 100 cubic feet of gas, pass 1 cubic foot of gas through the train; for quantities less than 1.0 grain per 100 cubic feet, pass 5 cubic feet. Maintain a constant rate of 3 cubic feet per hour. Disconnect and transfer the contents and distilled water washings of both bubblers to a 250 c.c. volumetric flask. Make up to the mark and shake. Burette 5 c.c. of this absorbent solution and titrate with N-HCl to methyl orange end point. Record this reading.* Burette another 5 c.c. portion of absorbent into a Nessler tube and neutralize without use of the indicator. Shake well or pass a stream of air into the tube for removal of sulphuretted odors. Add 12 c.c. of saturated picric acid solution and 4 c.c. of 5% Na_2CO_3, shake and place the tube in boiling water for 5 minutes to obtain maximum color intensification. Remove the tube and dilute to the 100 c.c. mark with distilled water. Compare the orange-red color obtained with standards prepared from a standard 100 ppm. HCN solution and distilled water; duplicating the procedure, omitting, however, the need for neutralization. Standards left open to air and light should not be used after 24 hours standing.

Calculations:

Express the HCN content of the gas stream in grains of HCN per 100 cubic feet of gas.

$$\frac{\text{No. c.c. of standard 100 ppm HCN} \times 7.715}{\text{Corrected volume of gas passed}} = \text{Grains HCN/100 c.f. of gas}$$

Limits:

In solution:
Rapid determination, 1 part in 20 million.
Discernible, 1 part in 50 million.
In gas stream by absorption:
Lower limit approximately 0.03 grain per 100 c.f. gas.

Another method by Seil,[9] requiring but little apparatus and a small amount of practice has given entire satisfaction to about 1 grain per 100 cu. ft.

The author states that this method depends upon the following facts:

1. The reaction between hydrocyanic acid and iodine in a sodium bicarbonate solution yields cyanogen iodide and hydriodic acid. The function of the excess of sodium bicarbonate is to neutralze the hydriodic acid as it is formed.
2. A mixture of cyanogen iodide and hydriodic acid yields hydrocyanic acid and iodine in acid solution.

(*Concluded on page 42*)

** Should the resulting color be too intense for accurate comparison against standards (maximum standard for comparison procedure should not exceed 5 ppm HON), reduce the volume of absorbent solution to 2.5 c.c., or if necessary, to 1 c.c. Multiply final calculations by a proper dilution factor, e.g., for 2.5 c.c., the factor is 2, for 1 c.c., it is 5, etc.*

A Successful Cooperative Sales Policy

By

T. F. Murphy

Sales Manager
Pittsfield Coal Gas Company
Pittsfield, Mass.

THE best method of operation of the sales force of a Gas Company is a question worthy of serious study by the leading minds in the industry throughout the country.

The subject is one endowed with innumerable ramifications and it is understood that a successful method of operation in one community may be a complete failure elsewhere.

This outline of our sales policy is offered with the hope that a national interest may develop which will lead to expressions of opinion from gas sales executives in all parts of the country.

The question is complicated by the number of combination companies selling both gas and electricity in the same territory.

Some gas companies do no direct merchandising, depending entirely on dealers; others attempt to sell all the gas burning appliances; while others operate with an active sales force of their own and with co-operative dealers.

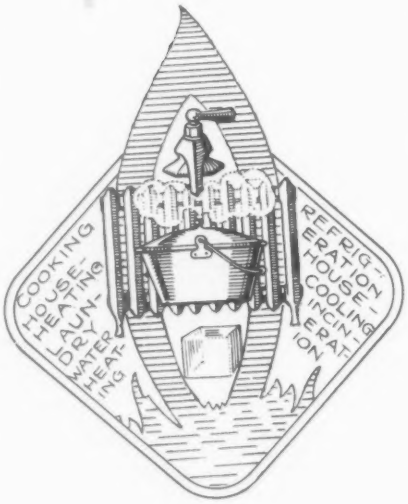
I approach the subject from the angle of an independent gas company, employing an active sales force and maintaining a cooperative dealer plan with both plumbers and range dealers in the territory served.

With an active sales force it is my firm belief that the best results can be obtained with zoned territories, with one salesman for every 2500 customers. The zoning of territories eliminates the duplication of effort and places the responsibility for results directly on the shoulders of one man.

One of the greatest difficulties encountered with this method of operation is the arrangement of territories so that the expected volume of sales is the same in all territories. Such an arrangement requires considerable study on the part of the man responsible for it. It may even require a new revision of territories at the end of each year.

One method of territorial arrangement which we are using with success this year, is the coverage of what was formerly two separate territories by two salesmen—one covering the odd numbers, the other the even numbers, (the opposite side of the street).

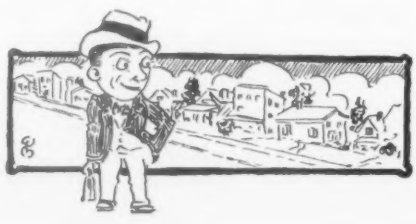
The figure of 2500 meters per



salesman enables each man to make a complete survey of his territory annually, which assures him, with conscientious work, of the ability to earn a good income.

The survey file, kept up to date, is of great value in the selection of lists for direct mail advertising, and the compilation of prospect lists for the salesmen when special sales activities are being conducted. Such lists are practically worthless unless this complete survey is available each year.

The method of compensation for the domestic salesman which seems best adapted for this type of operation is as follows: a weekly salary of $16.00 per week, with a 10% commission on the cash sales price of all appliances sold. In addition to the above, a monthly load building bonus of $25.00 is paid to each salesman making his monthly quota, and a $50.00 annual bonus to each salesman making his annual sales quota on ranges, refrigerators, and automatic water heaters.



Our present rate structure is $1.50 per MCF for 528 B.T.U. gas, with an alternative rate to the customer who has gas consumption over 2,000 cubic feet per month, and is using gas refrigeration or automatic water heating. This customer pays $.95 per MCF for all gas over 2,000 cubic feet per month.

A domestic salesman selling $10,000 a year is doing an average selling job, and with the foregoing earns $2282.00 per year as follows: weekly salary $16.00, or $832.00 per year; 10% commission $1000.00; monthly load building bonus $300.00; and the annual bonus of $50.00 each on ranges, refrigerators and automatic water heaters—$150.00.

We have for the past five years paid all employees outside of the sales department, 3% commission on all leads resulting in sales of any gas appliances within 60 days. The employee has the right of renewal of this "interested" slip for another 60 days if the sale has not been completed on the original slip.

Prize contest awards are made at the annual Christmas party of the company to the employees who have turned in the most "interested" slips which have resulted in sales. These awards are as follows: $50.00 first prize, $25 second prize, third fourth, and fifth prizes of $10.00 each. The employees are graded in classes A, B, and C depending on their opportunities for making sales contacts in the course of their work. Constant education of employees is essential to the successful operation of the outlined plan. This is carried on by daily morning meetings with the salesmen, and periodic meetings at less frequent intervals, with the employees of other departments of the company.

The dealer co-operative arrangement in our territory includes both plumber dealers and furniture dealers.

The furniture dealers may sell any gas equipment, but their sales consist mainly of ranges and refrigerators.

If appliances are sold from gas company stock, a 20% commission is paid to the dealer. The dealers however, sell many gas stoves from their own stock, and on these the gas

company pays the dealer salesman $2.00 for each range, and makes the necessary gas connection for the dealer without charge.

To carry on an activity of this kind it is necessary that the gas company take a sizable mark up on gas ranges to give the dealer an opportunity to carry his own line of ranges and sell them at a profit.

Our arrangement with the plumber dealers has been a much more difficult problem though it has been in operation for the past five years.

The master plumbers who are cooperating with us are the leading men in their line, in the community. They have been attending classes devoted to the proper installation of water heaters, and the advice and assistance of gas company engineers is available if they request it. These plumbers make all installations of water heaters sold by the gas company, and are paid a flat price for these installations. This price was predetermined and agreed upon by a Standards Committee consisting of seven members: 3 master plumbers, 3 Gas Company representatives, and a president, who may be either a master plumber or Gas Company representative.

These master plumbers are paid 20% commission for the sale of a gas water heater or 10% for a lead turned in which results in the sale of a water heater; in either case, the installation of the heater is assigned to the interested plumber. All sales of gas company merchandise turned in by the co-operative dealers are financed by the gas company, after they have been approved by the credit department.

The foregoing is but an outline of the sales arrangement which we know operates successfully in our territory and suggestions for improvement will be received with pleasure. Better still, a series of articles regarding other successful methods of operation will be carefully studied if they appear in your pages.

Billing Procedure of The Brooklyn Union Gas Company

BETWEEN 1933 and 1936 The Brooklyn Union Gas Company gradually changed its Customers' Billing System from one which was formerly decentralized to one of complete centralization.

The Customers' Accounting Divisions which were formerly located at eight various offices have been consolidated at two offices, one in Kings County and the other in Queens County. The office in Kings County carries about 550,000 meters and is located at 1024 Fulton Street, in the same building as the Billing Division. The office in Queens County is located at 89-67—162nd Street, Jamaica, Long Island, and carries about 246,000 meters.

Equipment Used

Billing equipment was added from time to time between the above dates, and the Customers' Billing Division now has the following at its Fulton Street office:

3 Addressograph Company combination bill printing and addressing machines.

32 Remington Rand public utility type billing machines with totalizers, synchronized with Powers tabulating card punching machines.

3 Electric Hand punches.
4 Powers sorting machines
3 Powers tabulating machines.

Procedure

Before sending the meter books to the Customers' Billing Division, the clerks in the Customers' Accounting Divisions review them for irregular billing, insert average readings in green ink and post arrears items to the respective accounts alongside of the present readings in the balance column. The arrears amounts appearing in the meter book are listed on a tape and the total arrears to agree with the outstanding balance figure at the time of billing. Meter count figures in sizes, open and locked, are entered on a form provided for this purpose. Meter books are then forwarded to the Customers' Billing Division with the following: Arrears listing, interest applied listing, meter count by sizes with open and locked recap, meter readers' daily report, and listing of skips. These memoranda are attached to the fly sheet in the front of each meter book.

On reaching the Customers' Billing Division, the Addressograph bills and the book are given to a billing machine operator, together with a sheet for the meter book bearing the operator's name and a time stamp record of when book was started by the operator.

The operator sets previous and present reading dates in the date cups of the billing machine, then sets the meter book number, branch number and current reading dates in the punch. These remain set in the punch and the billing machine for all the meters of this one meter box. Operator then places register sheet and carbon paper in the billing machine and is now ready to start billing the meter book.

The bill is put in the machine and the operator copies from the meter book the following on the bill, which is automatically copied on the register sheet by the carbon paper: The Rate, previous and present reading dates, present reading and previous readings and cubic feet of consumption, the meter reader having made the subtraction of the previous reading from the present in the meter book.

The star key is then depressed to prove the subtraction. If the subtraction automatically made by the machine does not agree with that made by the meter reader, depressing the star key will cause the machine to lock. The star key thus proves the entries made by the operator as being correct and also proves subtractions made on the meter book by the meter readers.

The operator then enters the

amount of sales in money, the New York City Sales Tax, and the arrears, if any. The amount of Sales in money and the New York City Sales Tax is either taken from memory or from charts, and the arrears from the meter sheet. The total amount due is copied from the cross totalizer and the star key depressed in order to prove that the figures have been correctly copied and totalizer cleared.

Automatic Features

As the bill is being made out, the following information is automatically set up in the punch: Rate number, cubic feet, amount of sales, amount of tax, account number, billing code, sales analysis code and meter size code. As the entry of the meter size code is finished the return lever on the billing machine is depressed and the carriage automatically returns open and punches the card on Powers punch machine. The completed bill is then replaced with a bill for the next account, and billing continued.

As the above figures are entered on the bill, the consumption, the amount of current bill, New York City Sales Tax, arrears, and total amount due accumulate in the vertical totalizers of the billing machine for the entire book. A totalizer is provided for each of these. When the meter book is completed and all accounts have been billed, these totals are copied from the vertical totalizers onto the register sheet. Operator then gives bills and register sheet to the Proving Section, Punchcards to the Tabulating Section and meter book to the Corrected Bill typists and then takes the next book and repeats the above procedure.

Corrected Bill Typists type names and addresses, part supplied, meter book number and account number on bills to be corrected, these bills having been placed in the meter book by the billing machine operator. Meter book, register sheet and bills are then sent to the proving clerk.

Checking Details

Proving Clerks check all corrections with the meter books for accuracy and neatness, check arrears listing and interest applied listing with figures shown on the register sheets in the arrears column and prove same. The Proving Clerks also check account numbers typed on bills by operators with the Addressographed account numbers appearing on bills to eliminate possibility of crossed billing.

While provers are checking this

Installation of Remington-Rand Public Utility Type Billing Machines synchronized with Power tabulating card punching machines.

information the punch cards are being sorted and tabulated by the Tabulating Clerks according to the following billing code: All cards in box No. 0 are regular one month bills, in No. 1 are regular no reading bills, in No. 2 are irregular bills, No. 3 are open meters that have been skipped by the meter readers, No. 4 are open meters that have been read no bill rendered, No. 5 are open meters to be verified, No. 6 lock meters read, No. 7 locked meters that have been skipped, No. 8 locked meters showing advance reading and No. 9 locked meters to be verified. In this sort we have our cards separated in open and lock meters, meters read and not read and revenue and non-revenue accounts. These cards are then taken from the sorters, and a count in the different billing codes and a grand total of all non-revenue cards is obtained, the latter coming from Boxes 3, 4, 5, 6, 7 & 9. The contents of Boxes No's. 1, 2, & 8 are then sorted by hand according to the different rates.

Sorting One-Month Bills

The only remaining cards now to be sorted are those that fell in Box No. 0. These are sorted so as to bring all cards of the same unit of consumption together. Finally they are sorted according to the different rates, those falling in No. 1 box being for No. 1 rate, 2 for No. 2 rate, 3 for No. 3 rate, 4 for No. 4 rate, 5 for No. 5 rate. Space cards are then placed after each step of the No. 1 rate cards by the sorting clerk as follows: No consumption, minimum consumption, (600 cubic feet or less), 3,000 cubic feet or less, 6,000 cubic feet or less, 10,000 cubic feet or less, and grand total cards are placed after all cards for more than 10,000 cubic feet of consumption. This gives sub-totals for the blocks of the rates and grand totals for all cards representing sales on No. 1 rate in this meter book. Grand totals are made up showing number of customers, cubic feet and amount of sales on the No. 1 rate. Cards on No.'s 2, 3, 4, and 5 rates are handled in a similar manner, according to the blocks of these rates, which are different from those of No. 1 rate.

Tabulating

After the sorting has been completed these cards are placed on the tabulating machines where the pertinent data are reproduced in proper order and the required totals obtained by blocks and by rates. The information appearing on these tabulated sheets is as follows: Card count, rate schedule, cubic feet of consumption, amount of sales, amount of tax, account number, billing code, analysis code and meter size code.

After tabulation has been completed punch cards and tabulated sheets are given to Proving Clerks who proceed to prove the meter count by sizes, open and locked, this being taken from the tabulated sheets and reconciled with meter record clerk's figures at the Commercial Office, and to make a recap of rate grand totals on tabulated sheets and to reconcile them with the figures provided by the billing machine operator.

Detecting Errors

In setting the cards in units of consumption by rates all regular billing for the same amount of consumption must carry the same amount of sales. If there is an extension error, proving clerk is able to detect it with no difficulty whatsoever, because the amount extended

incorrectly will show on the tabulated sheet at first glance. Prover checks the number of meters not read with the skip listing provided by the Customers' Accounting Divisions and also from the meter readers' report. Any discrepancies are corrected, and the meter reading section of the Accounting Division is notified by memorandum to make the necessary change. On accounts coded No. 5 and No. 9 the bills are returned to the Customers' Accounting Division with a memorandum for special billers to have meter readings verified.

On accounts coded No. 3 bills are attached to skip listing and returned to the Customers' Accounting Division awaiting a skip reading from the meter reading section. Prover then makes up a dual proof ticket from the tabulated sheet, which shows number of customers, cubic feet and amount of sales in the different steps of each rate and also proves with the tabulated sheet grand total by rates. These grand totals appearing on dual proof ticket by rates are then entered in section provided on dual proof ticket re-cap for sales on all rates; and the total amount arrived at on duals must agree with the total amount appearing on register sheet from billing machine.

After all entries have been proved, register sheets, bills, skip listings and skip bills, verify bills, arrears and interest applied listings, average reading bills and meter count slip are returned to the respective Customers' Accounting Divisions with the meter book.

Punch cards are sent to the Tabulating Section, and tabulator and dual proof tickets are sent to the Control Section in the Customers' Billing Division.

Control Section

The Control Section accumulates each day's readings from the duals by branches, enters into its controls the information by rates and steps of the rates and proves out each day's sales which are reported to the Customers' Accounting Divisions, showing the type of billing, such as regular meter books, skip billing, final billing, deductions from sales, special ledger billing, etc., and a grand total for the entire day, showing number, cubic feet of consumption, sales and tax. A report is made by the control clerks daily for the Accounting Department, General Office, showing the amount of sales in cubic feet by branches and total sales for the entire system.

After Billing Division control clerks check the number of readings taken and skipped with the Meter Reading Section of the Customers' Accounting Divisions, and the amount of sales for the entire month is checked with the control clerks of the Customers' Accounting Divisions, these figures are accumulated in the control and at the end of the billing period the monthly sales reports are made from these figures. When entries have been completed by the control clerks, dual proof sheets are placed in a binder in branches by days, tabulated sheets are placed in a separate binder, one for each branch, and are held for future reference. These tabulated sheets are used to assist in balancing meter count figures in subsequent months.

Completion of Routine

When meter book has been completed by the proving clerk at the Customers' Billing Division, punch cards are sent to the Tabulating Section. They are set in units of consumption by rates, which is a hand sorting operation. Cards are then sorted in sales analysis code, giving the number of customers on each sales analysis code and also in units of consumption. Punch cards are used from this point on in making up all sales analysis reports.

Customers' Billing Division maintains a 24-hour schedule. A meter book received at 10:00 A.M. today leaves the Customers' Billing Division before 10:00 A.M. the following day.

To sum up, The Brooklyn Union Gas Company has been able to compile more reports on the present procedure with less clerical help and confusion and complete their reports sooner than they were able to do under the old procedure. All these savings, in time, etc., have been accomplished by changes in Billing Division procedure because of the elasticity of the Remington Rand punch card system.

Fred H. Sargent Completes Fifty Years of Service

Fifty years of devotion to the interests and development of his Company was eulogized in emphatic terms on November 16th when about 350 employes of the Lawrence Gas & Electric Company gathered to fete Fred H. Sargent, president and agent of the company, in honor of his golden jubilee of service.

Officials of the New England Power Association, of which the local concern is an affiliate and of the local company were among the many employes and friends who honored the highly-respected and well-known executive. He was presented with a diamond-studded, 50-year service pin and with a guest book containing the names of all present. Many telegrams and letters from friends unable to attend the function were received.

This 50th anniversary dinner to Mr. Sargent carried with it the sincere appreciation of a task well done, beginning in the years when the service to the public was comparatively limited.

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The Law of Gas Supply Contracts

By
Leo T. Parker
Attorney at Law
Cincinnati, Ohio

LEGAL RECORDS verify the statement that a majority of litigations involving gas corporations relate to contract law. In fact during the past few weeks several important decisions, involving gas supply contracts, have been rendered by the higher courts.

It is important to know that the courts have consistently held that, when determining the legal obligations of contracting parties, the primary consideration is the intention of the parties. This intention must be gathered from an examination of the contract, which should be so construed, if possible, as to give meaning to every word, phrase, and clause and, also, render all of its provisions consistent and harmonious.

For illustration, in Henderson Development Company, Inc. vs. United Fuel Gas Company, West Virginia, 3 S. E. (2d) 217, reported July 13, 1939, it was disclosed that in 1918 the Henderson Development Company acquired eleven oil and gas leases in a county, and by July, 1919, had drilled three wells thereon which were producing gas in paying quantities. Thereafter it entered into a contract with the Charleston-Dunbar Natural Gas Company, which recites that it "has sold and does hereby sell unto" the gas company and agrees that the latter company may take all the natural gas which may be produced by the former.

This contract provides, among other things, that the gas company "shall furnish the pipe, construct and put into operation" an extended line of adequate and sufficient capacity, of not less than four inches in diameter, to receive and discharge the gas produced thereunder as the "extended line," shall run from the line or lines of the gas company to the "C. M. Wheeler" well.

The contract was for five years from November 1, 1919, and so much longer thereafter as gas is produced in paying and marketable quantities from the lands described therein, or which may be acquired thereunder, subject to the right of either party to terminate the contract whenever the development company is unable to furnish to the gas company as much as 100,000 feet of gas per day on an average during the twelve months of any year, and to declare any well non-productive should it fall below a daily capacity of 20,000 cubic feet.

On December 31, 1929, the gas company sold all of its property to the United Fuel Gas Company, which assumed all of the former's obligations. Five wells, in addition to the original wells, were drilled by the development company between 1919 and 1931. The development company requested the United Fuel Gas Company to connect a well located eight miles distant. The United Fuel Company refused to do so, and the Henderson Development Company filed suit and asked the court to compel it to fulfill the terms of the contract.

However, since the testimony proved that the lease, for the land on which *this well* was drilled, was *not* contemplated when the contract was signed, and also since the contract specified an "extended line," the higher court refused to compel the Henderson Development Company to connect the well with the United Fuel Gas Company's line. This court said:

"A cardinal rule in the construction of a contract is that its main object, or the purpose which the parties sought to accomplish, is to be considered in ascertaining their intention, and particular parts of the contract must be so construed as to harmonize with such purpose, if possible. . . . It seems clear from the foregoing that the contracting parties never intended to include a well eight miles distant from, and without intervening development connecting it with, the original development. . . . The parties to a contract are presumed to have used the words in the instrument in the sense in which they are generally understood."

The court's construction and interpretation of the contract was that the original intentions of the contracting parties was for the Henderson Development Company to construct an extended line to which other wells *then contemplated* should be connected. Since, when the contract was made, it was not intended by the parties that the Henderson Development Company should run lines from wells eight miles distant, the higher court held the Henderson Development Company not required to connect the new well.

Payment for Services

Various higher courts have held that any person who performs valuable services for another is entitled to recover reasonable payment. And this is so although the person benefitted made no promise or agreement to pay for such services.

With respect to services rendered by corporation officials there is little difference as to the legal principles applicable to a claim by an officer or director of a corporation for compensation. The rule supported by most of the modern and best considered higher court cases is that a director or official of a corporation may recover the reasonable payment for services rendered, either within or entirely outside the scope of his duties as such director or officer, if the circumstances indicate that the parties intended or understood that the official was to be paid. Obviously, if the official agrees to perform services without compensation he can collect nothing. But if nothing is said regarding compensation he is entitled to reasonable payment.

For illustration, in Johnson v. Tri-Union Oil and Gas Company, Kentucky, 129 S. W. (2d) 111, the litigation involved the right of a gas corporation president, named Johnson, to collect for services rendered by him. It was contended that since no agreement was made by which the corporation was to pay him for the services rendered that he was entitled to no payment. However, it is interesting to know that the higher court held otherwise, and said:

"Without setting out in great detail the numerous items of services rendered by Johnson to the company, we have come to the conclusion that much extraordinary service was rendered by him and that . . . he is entitled to some compensation for extraordinary services rendered by him."

Usual Contract Law

So, therefore, when considering whether a contract, relating to gas supply, is valid and enforceable the important consideration is: Was the act or thing or obligation, in litigation, intended by the contracting parties when the contract was made? If so the contracting parties are fully obligated.

On the other hand, as held in the above mentioned higher court case involving payment to the president of the gas corporation, the courts will, under certain circumstances, imply obligations *not* expressed in the

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IS WORTH A POUND OF CURE
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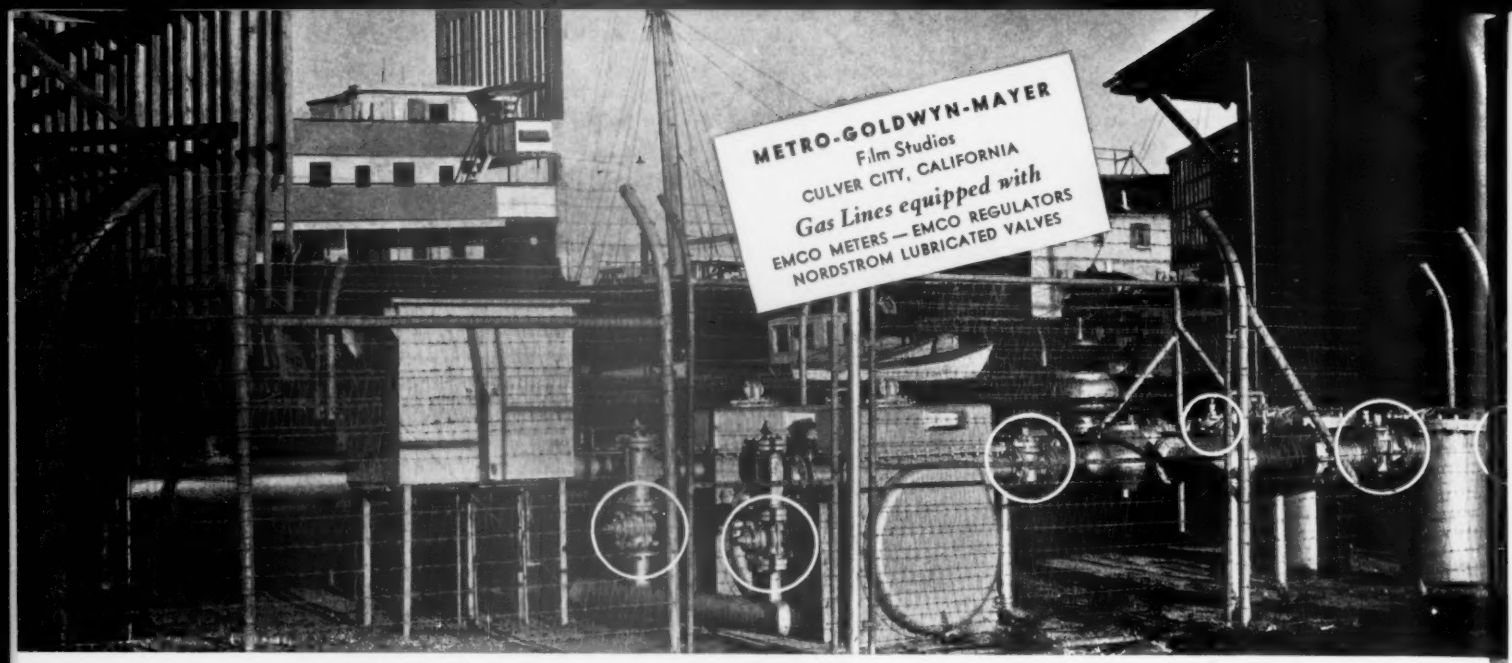
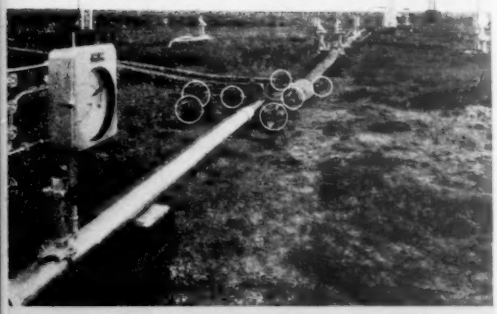
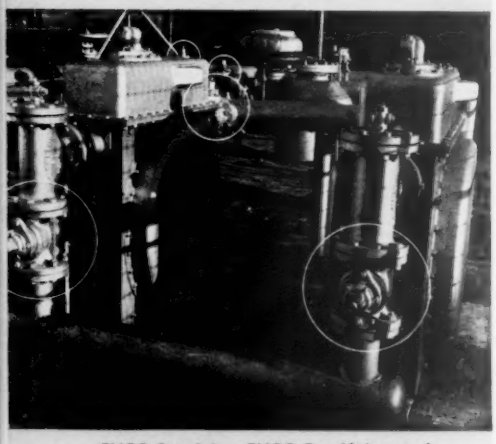




EMCO Orifice Meter and Nordstrom Valves on gas line.



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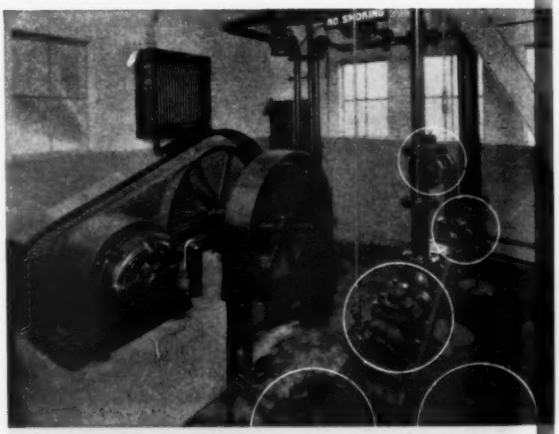

Nordstrom Valves on high-pressure lines to gas holder in Baltimore plant.

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contract, nor intended by the contracting parties when the contract was made. For example, the courts recognize the fact that no person expects to perform services without reasonable payment, unless the contract clearly states that no payment was expected. And, using another illustration, assume that two corporations enter into a contract containing clauses to the effect that one corporation will supply gas to the other. If the payment is clearly stated, the court will have no difficulty in deciding the rights and obligations of the corporations. But, if the obligations are not clearly expressed then the court will take testimony and endeavor to solve the *original* intentions of the contracting parties when the contract was made, the decision to be based upon the ultimate value of this testimony. Then, again, let us assume that by mistake an important element of the contract was omitted. Under these circumstances the court will endeavor, through testimony, to supply the clause which was omitted. These rules of law are applicable to all contracts, as well as to implied obligations of parties who perform acts or services under a contract.

For instance, let us review the case of Philadelphia Gas Works Company, 7 Atl. (2d) 326, reported July 29, 1939. The facts of this case are that the owner of a house noticed the odor of gas in his basement and upon making an investigation, he notified the gas company to come and make an inspection, as his hot water heater was leaking. The gas company officials failed to send a repairman, although the property owner again notified the company that gas was escaping in the basement. Soon afterward the property owner attempted to light the water heater. An explosion occurred which seriously injured him, and he sued the gas company for damages. He contended that the company officials were negligent in failing to send a repairman to inspect the basement and impart information that the gas water heater was in need of repairs.

However, it is interesting to know that the higher court refused to hold the company liable. The reason the court refused to hold the property owner entitled to recover damages was because the water heater was the property of the property owner, and there was no implied obligation on the part of the gas company to inspect another person's appliance and repair it. Obviously, a gas company impliedly guarantees to all gas consumers that its employes will not through negligence cause an injury. However, there is nothing in the usual written or implied contract between the company and consumers by which it may be implied that the company assumes responsibility to inspect appliances owned by consumers. Therefore, the fact that the gas company official refused or failed to inspect the premises was not legal negligence for which the gas company is liable. This court said:

"While a gas company is under the duty to exercise the highest degree of care . . . here the heater was not the property of the company . . . there was no duty resting upon the company to inspect or repair it."

Implied Duty to Inspect

Various higher courts have held that a gas company which installs appliances, lines or equipment impliedly agrees to use care to avoid injuries arising therefrom. Moreover, irrespective of the ownership of lines, mains, service pipes, or appliances, the gas company is liable in damages for an injury resulting from negligence of its employes to inspect and repair defects, providing the court may decide, by implication or from expressed contract provisions, that the company assumed the responsibility to make inspections and repairs. For the leading higher court on this point of law see Sekela v. Tokar, 6 N.E. (2d) 489, in which the testimony proved that the gas company had installed a gas range. A portion of the service pipe from the curb to the property, in which the range was installed, belonged to the company and the balance belonged to the property owner. When an injury resulted from gas leaks in the service pipe, the court assumed or implied that the company had, in its contract with the property owner, impliedly guaranteed that it would keep the service pipe in good condition providing, of course, it had knowledge that gas was escaping. Since the testimony proved that the property owner had notified the company officials of the leak, the higher court held the company liable for the injury because its employe was negligent in making the inspection and repairs. In this case the fact that the property owner owned a portion of the service was not important.

So, therefore, in all contracts, obligations, or assumed responsibilities, the court may readily imply certain conditions which may either result in the gas corporation being liable or relieved from all liability.

Ambiguous Contract

As above explained, the courts will use testimony in an endeavor to construe the original intentions or meaning of the contracting parties at the time a contract was signed or completed when such contract is later deemed to be ambiguous. With respect to this particular point of law the leading case of Southwest Pipe v. Natural Gas Co., 35 Fed. (2d) 248, is important. In this case a pipeline company and a gas company entered into a written contract by the terms of which the pipeline company agreed to furnish gas to the gas company. The clauses in the contract were not clear as to whether the gas company agreed to take all of the gas produced or only as much as it required to supply its consumers. The court promptly held the contract valid, and said:

"The uncertainties of the contract arise. . . . It is an agreement to take all of the merchantable gas in conformity with well established practices in the industry."

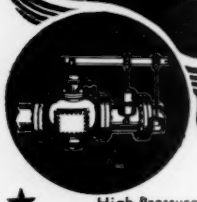
This means, of course, that where a contract is not *on its face* clear and apparent, as to the intentions of the contracting parties, then the court may refer to testimony of persons experienced in the gas industry. In other words, if persons experienced in the gas business may determine the actual meaning of the written clauses in the contract, by reference to phrases or words having special meaning in this industry, the court will adopt this meaning and require the contracting parties to fulfill the obligations.

Invalid Contract

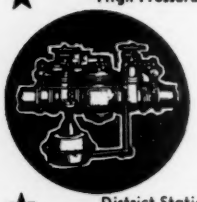
It is well settled law that invalid contracts cannot be enforced by either party. Of course, there are many reasons why a contract may be invalid. One of the most commonplace reasons, with special reference to gas supply contracts, is failure of the contract to contain a definite price for the product. Another reason why a contract of this nature is void arises from an incomplete agreement, as when one party agrees to purchase a stated quantity and the other does not agree to sell this same quantity. Furthermore, a contract is void if by reference to the contract itself, or to testimony, the amount of the product cannot be definitely determined. For example, a contract is valid if one purchases all the output of the other, because the quantity is ascertainable, but if one agrees to purchase and the other agrees to sell a quantity of gas which is indefinite or impossible to determine in the future, this contract is invalid.

All contracts which violate valid laws effective in the locality in which a contract is made are invalid. Moreover, a contract is invalid if made by a representative who has no direct or implied authority to make the contract.

THERE'S A REYNOLDS Regulator FOR EVERY GAS CONTROL REQUIREMENT



★ High Pressure



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For nearly half a Century, Reynolds Gas Regulators have proved their ability in a field outstanding for its rigid requirements. Reynolds has always maintained the lead in the development of Gas Control equipment that will give satisfactory control limits, capacity range and economic operation over a long period of time.

Accurate regulation at the station, in the line, at industrial plants or in the home — for every kind or type of pressure control equipment used in the Gas Industry, there is an especially designed product by Reynolds.

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REYNOLDS GAS REGULATOR COMPANY
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GAS CONTROL SINCE 1892

★AMERICAN MADE★

LAVINO ACTIVATED OXIDE

Supplied in unmixed form . . . ready for mixing with your own carrier . . . LAVINO "ACTIVATED" OXIDE is readily adaptable to the needs of your plant, whatever its size or requirements.

Not merely a "satisfactory" purifying medium by virtue of incidental properties, it is a material made specifically for maximum H_2S removal. As such, its practical capacity and activity are controlled factors. And, it offers maximum activity for trace removal and maximum shock resistance.

Composed of 65% (guaranteed minimum) to 70% Fe_2O_3 as received; approximately 10% moisture.

LAVINO ACTIVATED SLURRY

a new development in purifying materials, is shipped in steel drums . . . ready, with the addition of a small amount of water, to mix with any type carrier. Is used successfully also as a catalyst in liquid purification.

Contains 50% (guaranteed minimum) to 55% Fe_2O_3; 25% to 30% moisture.

LAVINO ACTIVATED SPONGE

is furnished ready mixed, carefully coated on large, tough, specially selected hardwood shavings.

E. J. LAVINO and COMPANY · 1528 Walnut St., Phila., Pa.

Steps To Sales Planning

By
William H. Matlack
East Saint Louis, Illinois

PLANNING a sales activity is one of the most important duties of the sales promotion group of any organization. A sales activity, as we talk of it here, is nothing more than a special planned effort to promote the sale of an appliance or group of appliances during a specific period of time. The purpose of the special activity may be that of saturating a given market or of load-building, or perhaps of both.

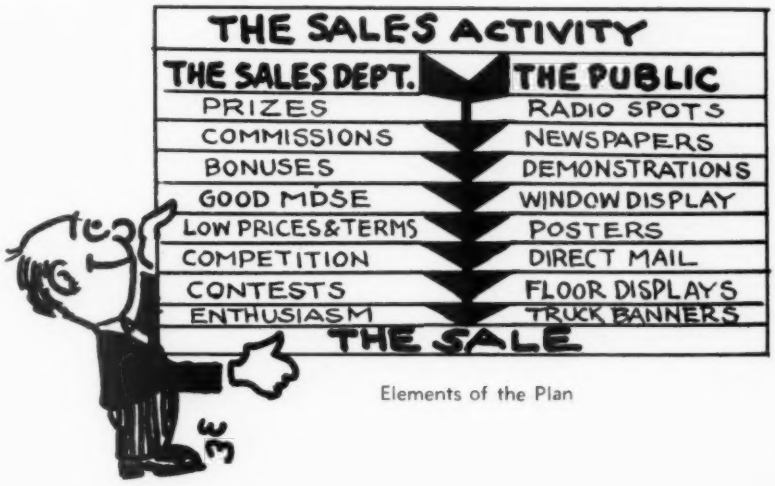
The reason for limiting the period of the activity is obvious. Records in the way of outstanding sales have always been made only when a definite period has been designated as a "MUST." Such activities also call for additional outlays of money for promotion. Of necessity, this must be taken into consideration and thought must be given to ways and means of justifying the additional

Showmanship

expenses. More money is needed for *Showmanship* to stimulate public interest in the merchandise offered; added prize money; commissions and bonus money to promote and stimulate the sales department and to engender enthusiasm and build a competitive spirit among the employees who participate. This spirit of keen competition is vital to the success of any special activity, and you can not well afford not to try for it.

Showmanship

Seasoned sales promotion men, without exception, are agreed that the one potent ingredient to mix in any sales activity is *Showmanship*.



Elements of the Plan

It is needed to get the plan of activity over in the first place, and it is also needed just as much to keep it in swing once it has been well launched. This *Showmanship* need not employ an entirely new or original idea (there ain't no sech animal nohow), but it may be an old rebuilt and redecorated one. The "Old Stove Roundup" staged by the Atlanta Gas Light Company together with the Roper Corporation years ago has seen many a rebirth and serves as an example of how an old idea may be given a new dress and be made to click. Under the direction of a capable *ringmaster-sales-promotion man* who can pack a "punch" into them, such activities,

Old Stove Round-Up

coupled with a "come on fellows we'll do it" attitude, will arouse the most apathetic skeptical salesman to the point where he will enter into the spirit of such a drive with enthusiasm.

All special sales activities should be predicated on the basis of *showmanship;—showmanship* to arouse and keep the public interested to the point where they feel a need for the wares being featured and want them; *showmanship* that creates an urge, an interest and a heartfelt desire on the part of the sales department to attain a pre-arranged objective, as well as an incentive to increase their earnings.

Writing the Plan

In writing the plan the following ten general divisions should be clearly, carefully and concisely covered;

1—General
2—Product or products
3—Prices and terms of Sales
4—Quotas
5—Billing and Delivery
6—Compensation
7—Meetings and Contests
8—Bulletins
9—Employes purchases
10—Advertising.

These ten suggested general divisions of the plan should be amplified somewhat by inserting such sub-divisions as may be required.

General Divisions

1—General.

(a) The Purpose of the Activity. Under this division should appear the organization's desires and the reasons for the activity.*

(b) The Name of the Activity. A good name lends to showmanship in any drive, promotes interest and provides something to talk about.

(c) The Duration of the Activity. Thirty days seems to be a logical period of time.

2—The Product.

The product and its features should be named in this division.

3—Prices and Terms.

Prices and terms play a big part in the show. If a special purchase enables special prices to be offered, this fact should be stated. If special terms and low down-payments are to be offered, this fact too should be stressed.

4—Quota.

All activities should have a definite objective. Set the quota by territories or departments, by groups or individuals, but by all means have a definite objective in units to be attained during the activity.

5—Billing and Delivery.

It is essential for the sales organization to know how merchandise will be billed and how installations and deliveries will be made. The purchaser may defer signing on the dotted line for months, but once he signs he expects delivery and installation of the merchandise "yesterday."

6—Compensation.

Here is a very important division. State in simple definite terms just what compensation will be paid, including special bonuses and prize money, and when the payments will be made. If there are different rates for different classifications of sales people, make that fact clear. Misunderstanding in regard to compensation is one thing that you cannot afford to allow to occur.

** It is assumed that the matter of prices, terms, rate of compensation, prizes, contests, meetings and matters bearing on policy have been agreed to by the management and that the accounting and stores departments have been consulted as to the part they are to play. These matters should all be worked out and agreed upon before the plan is written and released. Their wholehearted co-operation is essential to any smoothly running sales machine.*

7—Meetings and Contests.

Meetings held to inform all participants in the activity should be scheduled for departments or groups several days in advance of the opening of the activity. At these meetings, the plan should be explained step by step. If possible, an official of the Company should be present at these meetings to explain the Company's interest and express its desire to see the activity succeed.

Where a contest is to be conducted between salesmen, departments or groups, the plan of operation should be explained, and captains or leaders and teams selected at this meeting. The score board or chart to be used for tabulating the results from day to day should also be exhibited. The Sales Promotion Department should have and exhibit such promotion material as will be used, explain how it is to be used and state when releases will be made and what schedules are to be used.

8—Bulletins.

If sales bulletins are to be issued, the Sales Promotion department should explain what material is needed for them, and delegate the task of supplying it to one or several individuals.

9—Employee Purchase.

If employees are to be offered a special purchase plan, this should be carefully and clearly explained, giving prices and terms and the manner in which collections are to be made, etc.

10—Advertising.

An exhibit of all advertising to be employed, with dates of release should be made at the meetings. Special features of various types of advertising should be pointed out with the idea of having personal salesmanship tie into printed salesmanship. In this connection if a special campaign theme is to be used stress should be given this point.

The foregoing simply points out the essential factors to be given consideration in planning a special sales activity. It has been our idea to cover the main divisions to be considered and to supply a key which may be fitted to a plan for any type or size organization.

How to Stage the Activity

Stage your activity along these simple, obvious lines and your chance for success will be far greater than if you simply conduct a sale without first setting down in black and white *what you want to do* and *how you propose to accomplish it.* In writing your first draft it is well to have two or three copies made on plain paper double spaced for unless you are an unusual type you will find that your first draft will need much amplification and clarification.

Inject all the showmanship you can into your meetings, but *don't make them too lengthy.* Put showmanship into the contests; put showmanship into the store and window displays; and of course, put all the showmanship you can in the advertising. Plan the activity and then actually *push it* from start to finish.

PREPARED

With 600,000 bu. of GPM IRON HYDROXIDE purification material always stocked for immediate shipment, and our modern nine acre plant geared for increased production on short notice, *we are prepared to meet any oxide emergency.*

Gas Purifying Materials Co., L. I. City, N. Y.

TITAN WATER HEATER CONTROLS

AGA Approved TITAN Temperature and Pressure Relief Valve

This device is installed on the hot water outlet in the tank directly in the flow of water. Action, as a result, is unfailing and positive, there being no dead pockets to prevent proper functioning of relief valve.

Pressure relief is obtained through a spring-loaded valve which opens when the pressure reaches a predetermined point. Should the water become overheated to 200° F, a fusible disc melts and lets the water escape thereby preventing a further increase in temperature.

The Titan Relief Valve serves as a coupling connected in the line thereby eliminating the necessity and expense of a tee fitting. To replace fusible disc, it is not necessary to disassemble valves or piping in any way.

Design for application to storage or range boilers. Prevents corrosion, scalding and explosion.

Catalog and full information upon request.

The Titan Valve & Manufacturing Company

Thermostats • Safety Pilots • Relief Valves • Safetystats
9913 Elk Avenue Cleveland, Ohio

THE REPUBLIC EXHAUSTER

designed to solve your venting problems

Write or wire for special bulletin and prices.

AUTOGAS CORPORATION
2258 Diversey Ave. Chicago, Ill.
General Sales Agent: Republic Heaters Sales Co., Chicago

BARBER GAS Pressure Regulators

Barber precision-made Pressure Regulators are famous for reliability in operation, for positive response within narrow limits of pressure drop. Built on time-tested principles of design, with finest of craftsmanship and materials. All bronze body, brass working parts. Nicely finished and proportioned, their appearance is in perfect harmony with modern gas appliance styling. Certified by A. G. A. Testing Laboratory. Write for Catalog and Prices on Barber Conversion Burners, Appliance Burners, and Regulators.

Sizes ¼" up.

THE BARBER GAS BURNER CO.
3702-4 Superior Avenue
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GAS SERVICE STOPS

SINCE 1869 Hays has built dependable brass products for the Gas Industry. Standard, Special Weight, Heavy Pattern and High Pressure Stops to meet all requirements are manufactured by Hays in a full range of sizes. Write for Catalog No. 4 today.

HAYS MANUFACTURING CO. ERIE, PA.

All sizes up to 3,400 cu. ft. capacity

Meters
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METER REPAIR PARTS

FOR

ALL MAKES — ALL SIZES OF METERS

LARGEST GAS COMPANIES NOW USING OUR PARTS

SEND FOR OUR CIRCULAR ON METER REPAIR PARTS

SAMPLES AND PRICES GLADLY SENT

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PLAINFIELD, NEW JERSEY

THE BTU WATCHDOG

CONSTANT visual BTU indication SAVES LOSSES due to excessive gas quality variations. No complicated tables or involved calculations — No Sir! — It reads directly in BTU and has been designed by practical "gas men" to fill a definite need in the average gas plant — whether it be natural, artificial, mixed, propane or butane gas.

Distant alarm and indicator attachments provide a constant check on BTU content. The low cost of Connelly equipment is easily met by direct savings after installation.

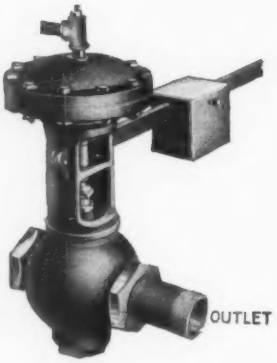
CONNELLY CALOROPTIC BTU INDICATOR

Send for this Bulletin

Just off the press—this new bulletin completely describes the operation of the Connelly Caloroptic BTU Indicator. Fully illustrated. Get your copy today.

CONNELLY IRON SPONGE & GOVERNOR CO. CHICAGO, ILL.—ELIZABETH, N. J.

Run Your Compressor at *Full Speed, with Safety*



FULTON
Compressor Regulator

For compressors, for electric-driven pumps working on gas, steam, air, or water—for any application where discharge must be kept constant — the Fulton Compressor Regulator is a trustworthy means of control. Any excess pressure in the discharge is instantly relieved and flow kept smooth, even, safe—your suction line will not be appreciably affected. Besides the lever type here shown, a spring-loaded valve is available and is equally sure-working. Ask for new Catalog of C-F Regulators for all requirements.

The CHAPLIN-FULTON MFG. CO.
28-40 PENN AVE. CF PITTSBURGH, PA.

"CLEVELANDS" Assure You MAXIMUM SAVINGS On Your TRENCHING JOBS!

The following Cleveland-Pioneered Features Tell Why: . . . • Weighs less than 5 tons • Less than 5 feet in overall width • 320 cubic inch engine • 4 speed and reverse engine transmission, plus 8 speed digging transmission, afford 32 instantly available digging speeds varying from less than 1 foot to over 32 feet per minute • Strength and dependability through supreme quality, rather than bulk and weight • Fast maneuvering through differential-brake steering • Well-balanced weight, concentrated *low* • All steel throughout • Over 80 Anti-Friction bearings. No babbit bearings • Frame, boom and buckets of high-strength alloy steel • All gears enclosed in grease-sealed steel housings, running in oil • Full range of ditch sizes, 10½" to 23" widths optional—5'6" depth • Truck speed transportation on special trailers.

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THE CLEVELAND TRENCHER COMPANY
"PIONEER OF THE SMALL TRENCHER"
MANUFACTURER OF A COMPLETE LINE OF WHEEL AND LADDER TYPE TRENCHERS — BACKFILLERS — PIPE-CRANES AND TAMPERS
20100 St. Clair Avenue *Cleveland, Ohio*

MATCHLESS SPECIFICATIONS, THEREFORE, MATCHLESS PERFORMANCE

Organic Sulphur*

R. E. KRUGER, Chairman

Rochester Gas & Electric Corp., Rochester, N. Y.

(Part of Gas Conditioning Committee)

O. S. Hagerman, Chairman

Atlantic Seaboard Corp.,
New York, N. Y.

SUBSEQUENT to meeting of the Gas Conditioning Committee in New York City in November 1938 the writer was asked to take over the chairmanship of a small committee to study further the advisability of removing organic sulphur from gas.

At this meeting in November it was suggested that before we ask for money to carry on research on organic sulphur removal from gas; it might be well if we could determine from field experience the importance of organic sulphur, and it was proposed that a comprehensive field study be made of a representative group of properties using gas containing organic sulphur and to compare those data with similar data covering properties using gas having no sulphur content; for example, a natural gas property.

In short since the Gas Conditioning Committee already had in its possession a comprehensive bibliography covering the available literature on organic sulphur and its relation to such gases as we handle, the next logical step was to get a measure as directly as we could of the importance of organic sulphur removal from our gas systems. We needed this in order to help us get a better idea of how much we should spend on research covering the removal of organic sulphur and too, to help us determine how much we could spend to remove the organic sulphur if a process can be developed.

Unfortunately, there were no direct data available but there was available, if it could be compiled, an enormous experience both with gas having organic sulphur present and with gas having no organic sulphur, or at least having very minute amounts of organic sulphur.

If the operating experiences of these two groups could be carefully collected and set opposite each other it seemed that the removal of organic sulphur could be more definitely evaluated. Our plan was to put two capable investigators in the field and let them make up a report covering field conditions in properties where manufactured gas containing organic sulphur was being used and similarly to make up a report covering field conditions in properties where gas containing no organic sulphur is used.

A study of such reports should indicate indirectly what we in the manufactured gas industry could expect if we were to remove all organic sulphur from our gas streams.

No funds however, were available for such a field study and it was realized that to obtain a fund would take a lot of extra time.

To avoid this O. S. Hagerman, chairman of the Gas Conditioning Committee, John Postles of The Philadelphia Gas Works Co. and the writer "got into a huddle" early in February 1939 and the writer, through the very good graces of the Rochester Gas and Electric Corporation, proposed to furnish at no expense to the American Gas Association a man to help make this important field study. The Philadelphia Gas Works Company through Mr. Postles agreed to do likewise. The committee as well as the Association is very deeply indebted to these two companies for making this donation.

Very shortly after the meeting in New York City the two field men, Mr. Bosbyshell of Philadelphia and Mr. Yeaw of Rochester were in the field and they continued there until about June 1, 1939.

The report turned in by these gentlemen just speaks for itself. We who have followed this thing through feel they did a very fine job. And it is their report. At the outset, Mr. Postles and the writer picked good men for the job; then we told them what we were after and told them where to go and they did the rest with the very fine cooperation of those whose properties they visited.

Attached to the report is another contribution from the laboratory staff of the Rochester Gas and Electric Corporation. This covers a laboratory investigation of the corrosive action of flue gases upon various metals when the original gas before combustion contains in the one case very small amounts of total sulphur and in the other case no sulphur at all. This contribution is really a supplement to a paper presented before this body by Shnidman and Yeaw in 1937. In addition too, it is a fine supplement to this report of the field work on organic sulphur corrosion. It is timely because it fits in very well with the main study, also it confirms the main report in that small amounts of sulphur are detrimental, and too it is valuable because it shows the relative resistance of a variety of metals to the corrosion of flue products and as such enables one to pick more intelligently a particular metal for some particular location. This will undoubtedly be of considerable value until such time that a process for the removal of sulphur is developed.

Attached also is the report of a fine piece of work done by the Chemical staff of the Brooklyn Union Gas Company. About two years ago the Brooklyn Union people volunteered to as nearly as possible duplicate the corrosion tests reported by Shnidman and Yeaw in 1937 (referred to above). It is generally well for an independent group of investigators to check on reports made by other groups. The present report constitutes that check. A comparative corrosion test was run on combustion products resulting from burning gas containing an average of 7.3 grains of organic sulphur per 100 cu. ft. on the one hand, and on the other hand a similar set of samples was exposed under similar conditions to a synthetic flue gas containing no

* *Part of Committee Report presented at American Gas Association Annual Convention, New York, October 9-12, 1939.*

TABLE I
AVERAGE ANALYSES FOR FUEL GASES DISTRIBUTED IN 1938

City	Type + of Gas	B.T.U. Per Cu.Ft.	Sp. Gr. Air=1	Per Cent by Volume									Gr. per 100 Cu.Ft.				
				Ill..	CO	H_2	CH_4	C_2H_6	C_3H_8	CO_2	O_2	N_2	Org.S	H_2S	NH_3	HCN	$C_{10}H_8$
A	a	1120	.650	—	—	—	82.0	14.0	1.0	0.1	0.2	2.0	—	—	—	—	—
B	a	1106	.646	—	—	—	87.0	7.2	2.7	0.0	0.0	2.0	—	—	—	—	—
C	a+b+c+d	804	.52	1.9	2.3	26.0	55.3	6.9	—	0.9	0.2	6.5	2.0	0	0	0	0.2
D	c	530	.65	7.3	30.4	35.2	7.3	3.6	—	3.2	0.9	12.1	3.2	0	0	0	—
E	b+c	534	.398	3.4	5.5	52.7	28.5	—	—	1.6	0.7	7.6	4.5	0	0	0	0
F	b+c	550	.400	3.4	6.4	54.3	27.6	—	—	1.7	0.5	6.1	5.8	0	0.6	0	Trace
G	b	530	.40	3.4	7.2	49.6	27.3	—	—	1.6	0.7	10.2	7.7	0	0	0	0.3
H	b+c	538	.515	3.9	11.0	44.1	26.2	—	—	3.1	0.2	11.5	8.3	0	11.9	0	1.4
J*	No. 1 b+c+e	545	.569	3.5	13.1	36.8	28.6	—	—	3.4	0.7	13.9	7.2	0	.4	1.7	Trace
J	No. 2 c	545	.671	8.7	29.8	34.0	13.2	—	—	4.0	0.7	9.6	9.5	—	—	—	—
K*	No. 1 b+c+f	532	.600	6.6	17.4	40.2	14.4	1.9	—	3.5	1.0	15.0	14.0	.03	.04	.01	1.2
K	No. 2 b+c	532	.597	6.3	11.7	43.1	18.9	—	—	4.2	0.9	14.9	8.3	.07	.17	—	1.7

a = Natural Gas
b = Coke Oven Gas
c = Carburetted Water Gas
d = Reformed Natural Gas
e = Refinery Gas
f = Coal Gas
– = No data available
* = Gas distributed from two separated stations, No. 1 and No. 2.

TABLE II
SUMMARY OF CORROSION RATINGS FOR REFRIGERATOR UNITS

City	Org. S Gr./100 Cu.Ft.	Units Inspected			Distribution of Ratings for Units Inspected										
		Total No.	Av. Age Years	Average Rating	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
A	<1	11	4.6	1.6			1	7	3						
B	<1	11	5.4	1.6			2	6	1	2					
C	2.0	17	5.7	2.6					4	7	5	1			
D	3.2	7	5.3	3.4						1	1	4	1		
E	4.5	25	6.2	3.2						2	11	11	1		
F	5.8	15	5.0	3.3						2	5	5	3		
G	7.7	5	3.4	3.8								2	3		
H	8.2	13	5.5	3.2							10	1	2		
J	8.4	16	5.9	3.7							2	8	5		1
K	11.0	19	5.3	3.6							4	8	7		

TABLE III
SUMMARY OF CORROSION RATINGS FOR HOUSE HEATING UNITS

City	Org. S Gr./100 Cu.Ft.	Units Inspected			Distribution of Ratings for Units Inspected										
		Total No.	Av. Age Years	Average Rating	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
A	<1	46	5.0	2.1			11	6	8	12	5	1	3		
B	<1	32	9.0	2.5			2	3	9	5	6	7			
C	2.0	36	4.5	2.9				1	9	3	9	9	4	1	
D	3.2	19	5.7	3.5						3	4	4	8		
E	4.5	34	6.6	3.7					3	2	5	6	15	3	
F	5.8	10	8.2	3.9							2	1	4	3	
G	7.7	7	4.3	3.3					1		1	4	1		
H	8.2	33	7.5	2.9					3	7	16	5	2		
J	8.4	37	3.8	3.4					1	3	10	13	10		
K	11.0	36	5.0	3.7					1	2	7	3	20	3	

TABLE IV
SUMMARY OF CORROSION RATINGS FOR WATER HEATING UNITS

City	Org. S Gr./100 Cu.Ft.	Units Inspected			Distribution of Ratings for Units Inspected										
		Total No.	Av. Age Years	Average Rating	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
A	<1	29	9.9	2.8				2	2	5	19	1			
B	<1	28	6.4	2.2	1		2	3	8	7	7				
C	2.0	38	5.4	3.2					2	7	12	11	6		
D	3.2	27	4.2	3.4					1	2	7	8	7	2	
E	4.5	34	4.5	3.4					1	7	9	6	4	6	1
F	5.8	39	4.3	3.6					1	1	9	15	10	1	2
G	7.7	14	4.0	3.6							3	7	2	2	
H	8.2	40	5.7	3.5					1	5	11	5	14	3	1
J	8.4	31	4.2	3.7					1			16	13	1	
K	11.0	74	5.2	3.4					1	8	20	19	23	2	1

TABLE V
SUMMARY OF CORROSION RATINGS FOR ELECTROLUX REFRIGERATOR FLUES

City	Org. S Gr./100 Cu.Ft.	Units Inspected			Distribution of Ratings for Flues Inspected						
		Total No.	Av. Age Years	Average Rating	0.0	0.5	1.0	1.5	2.0	2.5	3.0
A	None	8	4.6	0.1	7	1					
B	None	11	5.4	0.1	8	3					
C	2.0	16	5.7	0.8		7	8		1		
D	3.2	7	5.3	1.2		1	2	4			
E	4.5	24	6.2	1.4		2	12	6	1	1	2
F	5.8	15	5.0	1.4		2	3	6	3	1	
G	7.7	5	3.4	1.7			1	3			1
H	8.2	13	5.5	0.9		2	11				
J	8.4	16	5.9	1.4		3	4	5	1	2	1
K	11.0	19	5.3	1.3		3	6	6	2		2

sulphur compounds whatever. This report, like the laboratory report of the Rochester Gas and Electric Corporation, gives a clear indication of what might be expected from various metals exposed to flue products containing sulphur and to flue products containing no sulphur.

And all three divisions of the composite report indicate quite clearly that we have a right to expect very much less corrosion from flue products if they contain no sulphur compounds. We are deeply indebted to The Brooklyn Union Gas Company for their fine contribution.

(Space limitations have made it impracticable to reproduce the above mentioned report by Shnidman and Yeaw of Rochester and also that by Murphy of Brooklyn Union Gas Company. The more important parts of the report by Bosbyshell and Yeaw are given below.)

Corrosion Survey

A Field Study of the Corrosion Resulting from the Combustion of Fuel Gases

I. Summary

The object of the field study to be described in the following paper was to evaluate the relative effects of the combustion products of the fuel gases distributed in the various properties in which the survey was conducted.

The results of the survey indicate that:

1. The condensation of vapors, which are formed during the combustion of fuel gases containing sulfur, results in the corrosion of combustion chambers and flue pipes.
2. Sulfur must be reduced considerably below two grains per 100 cu. ft. of fuel gas to eliminate corrosion problems.
3. Other constituents of the products of combustion do not appear to be significant with respect to corrosion.

The procedure followed in making the corrosion survey was to visit several homes on the various properties, and inspect the combustion chambers and flue conduits on certain equipment in which the city gas was being used as fuel. Attention was particularly directed toward Electrolux refrigerators, house heating units, and water heaters. The effects of corrosion by the flue products in each unit examined were evaluated according to a prearranged Corrosion Scale, the final rating being assigned only after discussion between, and agreement by, the men who conducted the survey. The Corrosion Scale[1] adopted is defined as follows:

Corrosion Scale

Rating	Definition
0	No effect
1	Color change
2	Strongly colored
3	Slightly scaled
4	Badly scaled
5	Very badly scaled

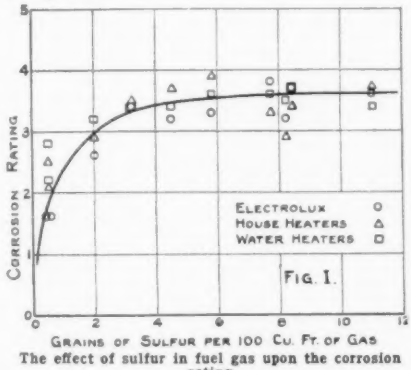
Besides evaluating the effects of the products of combustion, photographs were made in as many instances as it was possible or feasible to obtain them. Also a large number of the deposits were removed and subjected to a qualitative chemical analysis conducted during the period of the inspection.

Inspections were made during February, March, and April, 1939.

II. Discussion of Results

The Analyses of the Fuel Gases

Table I includes the detailed analyses of the fuel gases distributed in the several properties included in the survey. These data were obtained from the various company's records for the year 1938, but it is believed that the general operation has been consistent enough in each property, so that the data can be considered representative for at least the past ten years.



The effect of sulfur in fuel gas upon the corrosion rating

It should be pointed out that both City A and City B have been supplied with natural gas for many years. This gas has been obtained from the same general area for both cities, and has been considered to be essentially sulfur free, although no specific information upon this point was available. That some sulfur has been present in this gas was evidenced by the fact that sulfate was found to be present in a number of the scales and deposits removed from various types of units for chemical analysis.

In the manufactured gas areas regular analyses of the fuel gases are made, and the sulfur content has been specifically checked by the generally accepted Referee's test.[2]

Corrosion Ratings

A total of 783 separate units in ten different properties were inspected during the survey. Summaries of the corrosion ratings for Electrolux refrigerators, house heating units, and water heaters are presented on Tables II, III, and IV respectively.

(a) *Electrolux Refrigerators*

Table II includes the corrosion ratings for Electrolux refrigerators. The city in which the survey was made is given in the first column. The average organic sulfur content of the fuel gas distributed is given in the second.

The third column shows the number of units actually inspected during the survey. In some instances this figure represents only a small fraction of the total number of units in service in the community, but it is believed that the random choice of about a dozen units in each locality has given a good representative picture of conditions on the whole.

The fourth column shows the average age of the units inspected. Electrolux refrigerators have been on the market for about 10 years, and an effort was made to visit at least one model sold in each of the years since they were first introduced.

The fifth column shows the average rating for all of the units inspected in each of the properties visited. These averages were obtained by multiplying the number of units by their respective ratings and dividing by the total number inspected. Thus, if two units are each rated 1.0, and three units are each rated 3.0, the average rating for the five units is computed as follows:

Average rating =

$$\frac{(2 \times 1.0) + (3 \times 3.0)}{5} = \frac{11.0}{5} = 2.2$$

It will be noted that in general the average ratings rise with the increase in sulfur content of the fuel gas, thus indicating the increase in corrosion due to this constituent in the gas. There are a number of factors which should be considered in this comparison, however, and these will be reviewed in another part of this paper.

The remaining part of Table II shows the distribution of corrosion ratings for the units inspected. Thus in City A one unit was rated 1.0,

seven were rated 1.5, and three were rated 2.0. It will be noted that the original Corrosion Scale has been expanded by including half ratings. These were introduced to include border line cases which did not seem to fit comfortably into the six classifications originally specified.

The data in the last part of Table II also show the advance in corrosion due to the increase in organic sulfur in the gas, but here the distribution seems to bring out some details not so obvious in the average ratings given in the fifth column.

(b) *House Heating Units and Water Heaters*

The data in Table III include the corrosion ratings for house-heating units, and those in Table IV for water heaters, which were inspected during the survey in the various cities. The same general tendencies indicated in Table II for Electrolux refrigerators, are also indicated in Tables III and IV, but the relationship between corrosion and organic sulfur content of the fuel gas is not quite so specific as in Table II. Some of the more obvious reasons for this and for some of the other deviations will be outlined in another part of this paper.

(c) *Summary of Corrosion Ratings*

The average corrosion ratings for Electrolux refrigerators, house-heating units, and water heaters were plotted on cross section paper, and a smooth curve was drawn through the points as shown on Fig. I. This curve represents graphically the relation between the sulfur content of the fuel gas and the corrosion ratings. The curve rises sharply from a low rating for gases containing low sulfur content to the appreciable rating of about 3.0 for City C gas which contains 2.0 grs. of sulfur per 100 cu. ft. of fuel. The curve rises only slightly for gases containing from 2.0 grs. to 11.0 grs. of sulfur. This indicates the necessity for the removal of practically all of the organic sulfur from fuel gases to eliminate the corrosion problem.

That corrosion is not changed materially by small changes above 2 grs. per 100 cu. ft. of gas in the sulfur content of the gas is borne out by the general service experience in City J and City K. Each of these cities is supplied by different manufactured gas mixtures from two widely separated locations. The sulfur contents of these gases, as indicated on Table I, are 7.2 and 9.5 grs. of sulfur per 100 cu. ft. of gas in City J and 8.3 and 14.0 grs. of sulfur per 100 cu. ft. of gas in City K. No difference in corrosion has been noted in either city between the sections supplied by the high sulfur gas as compared with the sections supplied by the low sulfur gas. Particular attention was also given to this detail in City K during the present survey and this result was confirmed.

A possible explanation for the rather sharp increase in corrosion rate, in the presence of very minute traces of sulfur in the fuel gas, may be the precipitation of relatively strong solutions of sulfuric acid at the dew point, due to the low vapor pressure of this substance, which is formed in the condensation products of these flue gases.[1, 4, 5, 6]

Flue Pipe Corrosion Ratings

It was discovered at the start of the survey that a second and simpler corrosion scale was necessary for the evaluation of the effects of the combustion products of the fuel gases on flue pipes. The metal generally used in flue pipe is usually quite thin, and even a little corrosion causes relatively serious damage.

The corrosion scale adopted for flue pipe is defined as follows:

Flue Pipe Corrosion Scale

Rating	Definition
0	No effect
1	Noticeable evidence of corrosion
2	Perforated
3	Badly perforated

The rate of corrosion in the unit and on the flue pipe was nearly always different in degree, and it could not, therefore, be included in a single rating applicable to both. Furthermore, with few exceptions, there was no way of estimating how long the flue pipe had been in service, and this was complicated by the fact that, in many cases, it was obvious that sections had been replaced from time to time. It is for these reasons that no data for the corrosion ratings of flue pipes on house heating units and water heaters have been included in this paper.

The case of flue pipes or dilution tubes on Electrolux refrigerators is somewhat different in these respects. As a rule, this part of the unit was generally found to have been in place during the entire life of the refrigerator, and these ratings are therefore more reliable indicators of the effects of corrosion.

Table V includes a summary of these Electrolux refrigerator flue corrosion ratings. It will be noted that in general the distribution of the ratings follows that shown by the data in Tables II, III and IV, and on Figure I, and confirms the conclusions indicated there.

It is obvious that in order to inspect these dilution tube fittings properly, the refrigerator must be disconnected and pulled out away from the wall in most cases. It was not always feasible to do this in the customer's home, and for this reason, where doubt existed, no rating was made, which accounts for the smaller number of such ratings in Table V, as compared to the number of units inspected as shown in Table II.

III. Factors to be Considered in the Evaluation of the Corrosion Ratings

Limitations of the Corrosion Scale

In the first place, it is obvious that the corrosion scale, by which the effects of the combustion products upon all of the 783 units inspected were individually measured, does not differentiate between corrosion by sulphur and corrosion by any other means. It should be kept in mind, however, that a considerable number of deposits were removed and analyzed, and all were invariably found to contain very definite quantities of sulphate. Thus, sulphur was specifically shown to be an active agent in the corrosion of the units.

The corrosion scale does not differentiate between surfaces of metals of varying thickness, either. Thus, a corrosion rating of 3.0 or 4.0 on a heavy cast iron unit is not so significant with respect to the life of the unit, as such a rating on a steel drum, or on the recently designed thin-walled alloy metal units.

Use Factor

Normal use is a somewhat variable condition. In the case of Electrolux refrigerators, the effect of this factor upon the corrosion ratings was only slight.

In the case of water heaters, this use factor was found to be generally variable, depending chiefly upon the amount of water used in the home. Differences were quite clearly apparent in some instances, and an attempt was made to include this consideration in the original data by a note referring to small, medium, or large family use.

As a rule, house heating units of various sizes are installed to meet specific heating loads, and these units are, therefore, not called upon to operate under such individually variable conditions as are the water heaters. This is reflected in the data in Table III. It is suggested, however, that the use factor should be

considered in the general comparison of the data for different cities which have different heating seasons due to their geographic locations. (Table VI.)

TABLE VI
NORMAL DEGREE DAYS SEPT., 1937 TO JUNE, 1938, INCL.

City	*Degree Days*
F	7850
H	6732
C	6290
A	6155
E	6045
D & G	6036
J	5347
B	5235
K	4855

Service Factor

Probably one of the most significant individual factors which influenced the corrosion ratings is the service given the units by service departments of the various gas companies or by other service agencies.

In general, it may be stated that the amount of service rendered is fairly proportional to the degree of corrosion encountered. This must be qualified somewhat, since some gas companies consider it necessary and good business to give a great deal more service than others.

Age Factor

Among other factors, the age of the units must also be taken into account, for it is evident that surfaces must be exposed for a period of time in order to acquire corrosion products in sufficient amounts to be rated acording to the prescribed corrosion scale. It has just been indicated, however, that servicing tends to overcome the time factor, particularly in the case of house heating units, which are overhauled and thoroughly cleaned every year in the manufactured gas areas.

Type of Unit

An effort was made in conducting the survey to inspect as many corresponding types and makes of units, which were in general use in all of the cities visited, as it was possible to find. In the case of Electrolux refrigerators, this was accomplished quite satisfactorily, but it was much more difficult to carry out in the case of house heating units and water heaters, because of the great variety of these types of equipment available in the market.

Replacement Factor

The matter of replacement of parts or whole units in some instances was also considered. It is known that some Electrolux units and flues have been replaced in some of the manufactured gas areas, and that boiler sections in house heaters have also been changed in these territories. In every case possible, these units were disregarded in the survey.

Conclusions with Respect to the Evaluation of Corrosion Ratings

The prescribed corrosion scale adopted as a measure of relative corrosion conditions cannot and does not take into account all of the various factors involved in the corrosion of the units by the flue products resulting from the combustion of fuel gases. All of the units are variously affected, the general tendency being to bring the ratings closer together in the scale, and thus to tend to mask the actual extent of corrosion. This is particularly true in the comparison of the ratings made in natural gas areas with those made in manufactured gas areas. Conditions are actually much better in the natural gas territories than one might be led to think from a brief survey of the ratings alone.

Probably the Electrolux refrigerator units are the least affected by these factors, and these ratings are, therefore, the most reliable indicators of relative corrosion conditions. But even in this case, the amount of service given these units in various cities plays a most important roll in keeping the units in satisfactory running order year after year.

The factors discussed in this part of the paper have not been offered as an alibi for the corrosion scale adopted, but as an aid in amplifying the tendencies clearly indicated by the data presented.

IV. Photographs

In evaluating the effects of the corrosion of various types of units by the flue products resulting from the combustion of various fuel gases, photographs were made in as many instances as it was possible or feasible to obtain them.

V. Nature of the Corrosion Products

As has been previously stated, a large number of deposits were removed from many of the units inspected in all of the cities visited. These were tested specifically for carbonates and sulfates and also for the metallic element involved. All such deposits were invariably found to contain sulfate in varying proportions. No carbonates were indicated in the deposits removed from the units or flue pipes. Carbonates were found in the chimney openings and in the deposits which exuded from the brick work around the base of the chimneys, however.

In general the deposits found on iron or steel heating units or on sheet iron flue pipe varied in color from white to greenish white to light brown to dark brown or rust color. The metallic element was naturally iron. A white or greenish white almost pure crystallized ferrous sulfate was usually found in patches some distance from the actual scene of corrosion, having been carried there in solution by the condensates precipitated in the units. A white dehydrated ferrous sulfate scale was also found inside the combustion chamber itself. A thin loosely adhering dark brown scale resembling ordinary rust, and usually referred to as such by service men, was found inside cast iron and steel heat exchangers, and was composed largely of ferric sulfate. A light brown, thin skinned, and very brittle, hollow bubble type of deposit, composed of a mixture of iron sulfate with other metallic sulfates, was found in the combustion chambers of the underfired tank type automatic storage water heaters.

A considerable number of old sheet iron flue pipe was found in the natural gas territories. Some of this, although still retaining its original outward shape and general usefulness, was so brittle that it would fall apart at the slightest pressure. Sulfate was found to be present in these disintegrated pieces.

Aside from cast iron and steel, galvanized iron and copper seemed to be the most commonly encountered metals. Zinc sulfates were found in storage water heater combustion chambers, and around flue pipe joints or anywhere else where galvanized metal was involved. These deposits were more of a runny type, and were usually found some distance away from the scene of corrosion. Because of the whiteness of zinc sulfate, it contributes toward a messy appearance of the general installation.

Copper sulfate was usually found as a dehydrated white powder which was very readily identified. In some cases, in the presence of an excess of condensed moisture, such as in long copper flue pipes or in the bases of instantaneous water heaters, the bright blue vitriol crystals were found as such.

Tin, lead, and aluminum sulfates were also specifically identified in certain installations. Calcium and

ammonium sulfates were found in some chimney deposits along with sand and pieces of brick.

One other deposit should be included in this list, namely carbon. Practically every unit in the natural gas territories was heavily coated with free carbon. In some instances flue interspaces were practically closed up. Burner adjustments seemed to be generally poor, and carbon was found in the units, flue pipes, and even piled up in the base of the chimneys. This carbon coating may have served to protect the metal beneath or it may have served to hide the conditions. At any rate sulfates were found in it as well as elsewhere. Some carbon was found also in the units in the mixed gas areas, but practically none was found in the strictly manufactured gas areas, except in a very few cases in which the burner had been accidentally thrown out of adjustment.

VI. Evidences of Moisture

The theoretical dew point of the products of combustion of natural gas is about 138° F. and that for manufactured gas about 140° F. In the latter case the presence of sulfur raises the dew point somewhat. The actual dew point of the gas distributed in City H has been shown to be 158° F. for the theoretical mixture.[8] Thus the actual dew points of the two types of gases may differ by as much as 20° F. Whether or not this difference actually plays any real part in the presence or absence of evidences of moisture is questionable, but it is certain that there were very few evidences of moisture around the units, flue pipes, and chimneys, in the natural gas territories as compared with the corresponding locations in the manufactured gas areas. Some trouble has been encountered in the natural gas territories with moisture, but apparently only in isolated cases. No particular care has been given in the matter of chimney linings. In the cases of a few of the more efficient gas designed units, considerable quantities of corrosion products were found on the units and on the flue pipes indicating that a corrosive condensate had been encountered, but in the main the moisture problem did not appear to be serious in the natural gas areas.

This happy condition did not exist in City C however. Plenty of trouble from this source has been experienced, and there was abundant evidence of this among the units inspected there. In the strictly manufactured gas areas, conditions were even more serious. The moisture problem in these areas is complicated by the extreme corrosiveness of the condensate formed.

Evidences of moisture and of actual corrosion are closely associated as might be suspected. Some moisture and a slight corrosion were encountered in natural gas areas, but the problem is not serious there. The presence of as little as two grains of sulfur in the fuel gas resulted in a very marked increase in condensation products from the flue gases and corrosion ratings jumped correspondingly.

There is one further aspect of this situation which should be considered at this point. In some areas it was found that certain changes had been made on some installations in order to increase the flue temperatures and thereby prevent condensation. The sale of certain types of highly efficient units is discouraged, baffle plates are removed, secondary air to the burner is increased, and in some cases hot gases are bypassed to the flue. This results in a loss in efficiency at some cost to the customer, but it also helps to overcome the disagreeable condensation of moisture in the customers property and reduces service calls.

In this connection it is suggested that one possible reason for the lack of evidences of moisture in the natural gas areas may be the less careful initial setting and the general lack of subsequent regular inspection and servicing as compared to the practice in manufactured gas areas. This is no reflection upon the service departments in the natural gas districts, since the fuel there is cheap, and there is no particular demand for high efficiency.

VII. Flue Pipe

That a certain amount of moisture will result in the efficient utilization of the heat from the products of combustion of gas fuels seems inevitable. That the presence of traces of sulfur results in such an extremely corrosive medium is most unfortunate. To-date the only method of avoiding trouble is to conduct the flue products to the outside atmosphere through corrosion resistant conduits. The chief difficulty with this seems to be that no such universally suitable corrosion resistant material is available.

The old fashioned sheet iron flue pipe is practically useless for the purpose, and the fact that a considerable amount of this kind of flue pipe was found to be in use in the natural gas districts is proof in itself that the corrosion problem in those areas is not serious.

Galvanized pipe is the next cheapest material commonly available for the purpose. This was found to be in very general use everywhere. It will not, however, resist the attack of the sulfur-bearing flue gases, and must be replaced in varying periods from a few months to 4 or 5 years, depending upon several conditions. In one property the claim was made that it had been found to be less expensive to replace this cheaper pipe than it was to install a more costly pipe which would be eventually destroyed anyway.

Asbestos wrapped galvanized pipe has been tried and found to be very little better than the bare pipe. A double flue pipe which consists of two galvanized pipes, one inside the other with ½ to ¾ inches of insulation between is being tried in one city. The particular problem there was to conduct the flue gases a considerable distance away without condensation.

Another zinc coated product called Wilder metal was found in very common use for flue pipe in certain manufactured gas areas. This material seemed to give much better service than the ordinary galvanized pipe.

Copper flue pipe was very abundantly found in one locality and in some other scattered locations also. It has been in use longer than any of the other common metals or alloys except the zinc coated iron, and it seems to have given quite satisfactory service with the exception of some particular installations.

Aluminum flues were found in several scattered locations. They seemed to have given much better service than the cheaper materials, but whether the increased service overbalances the cost factor is in doubt. Aluminum too is eventually destroyed by the corrosive flue gases.

Among the more recently recommended materials are transite, lead-lined copper, and chrom-nickel 18-8 stainless steel. None of these have been in use long enough to show definite results. It is indicated that condensates soak right through transit. These liquids leach out the binder and a swelling and disintegration then takes place. Preliminary observation appears to show that corrosion occurs in both lead-lined copper and stainless steel, and it is therefore only a matter of time before these materials will be destroyed

by the condensation products of the flue gases.

The problem of moisture and the corrosion of flue pipe has been studied from the point of view of improving the method of installation. Most gas companies insist upon a more or less general supervision at the time of installation, but one insists upon placing the house heater close to the chimney and of actually changing it into that position if it has already been installed. In one locality all draft hoods usually supplied with the units have been removed and either placed in the line just as it enters the chimney or replaced with a modified diverter which is placed at the same point. Some service departments adjust the burner settings to supply enough heat to the flue pipes to keep them well above the dew point, and thus avoid trouble.

The problem is far from settled anywhere, and doubt is expressed in some quarters that it can ever be satisfactorily settled until sulfur is removed from the fuel gas.

VIII. Chimney Linings

A situation similar to that in the case of flue pipe exists in the case of artificial chimney linings. Nothing excels a properly constructed tile-lined chimney. Lacking this, however, substitutes are necessary.

Various metals have been tried without much success. One or two aluminum chimney linings were found which were very evidently badly attacked. Copper linings were found to be in equally bad condition. Electrolytic lead on both sides of the usual copper flue pipe is being used in one city, but it is being attacked by the flue gases particularly around the edges, bolt holes, and scratch marks. The same is true in the case of vitreous enameled iron which is used almost exclusively in another city. High chromium steel has been shown to be very actively attacked and destroyed, and the chrome-nickel 18-8 stainless steel which has been recommended has yet to be given a fair trial. Laboratory tests on this material do not seem to have given consistent results.

Transite has been used in some comparatively recent installations as a flue liner. A few were noted in the present survey which looked pretty badly messed up. Indications seem to show that moisture soaks through the transite and destroys its usefulness.

No completely satisfactory method for the proper protection of chimneys, which were not correctly tile-lined when they were constructed, is available at the present time.

Signed:

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Jesse S. Yeaw, Rochester Gas & Electric Corp.

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Booster-Recovery Installation for 180° Water Heating

In his talk "There Is A Commercial Water Heating Market" before the May 1939 meeting of the Industrial Gas Section of the American Gas Association at Brooklyn, Mr. W. S. Walker of the Consolidated Edison Company of New York, Inc. focused the attention of the entire gas industry on the fact that "Opportunities for securing commercial water heating business are greater today than ever before" and that the market is still largely untouched.

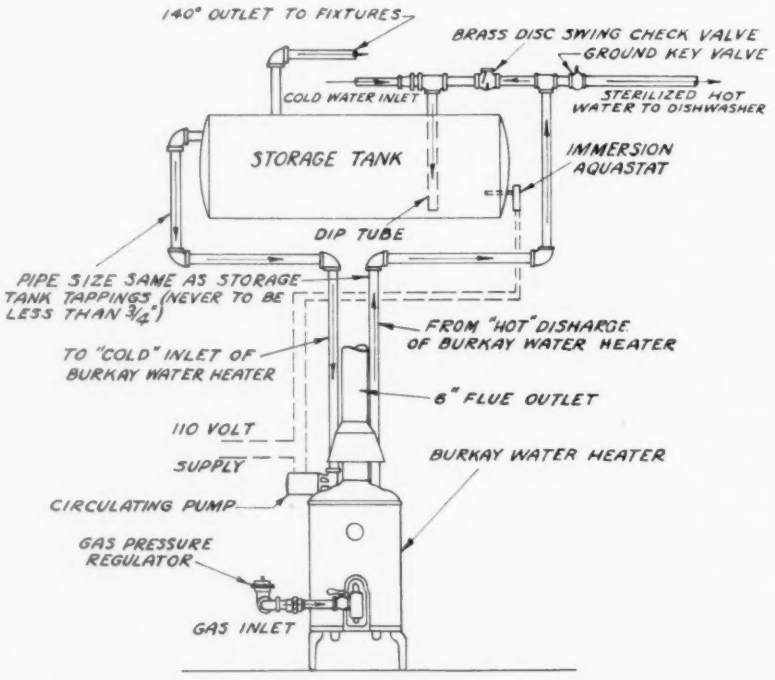
By no means the least of the factors which contribute to commercial gas load building possibilities is the fact that many communities throughout the country are becoming increasingly active in the enforcement of existing city laws requiring use of sterilizing temperature hot water for thorough, sterile rinsing of dishes and other tableware in public eating places. The operation of commercial dish washing equipment is also largely dependent on an adequate supply of hot water at sterilizing temperature for dish rinsing if completely satisfactory results are to be secured.

Gas, and gas fired equipment, will supply this required sterilizing temperature water at less cost than will any other fuel because of the intermittent demand. The resultant gas load is most desirable as the demand is nearly uniform throughout the year and the market is far from being saturated and certainly it is not highly competitive. Until now, however, the impracticability of maintaining the entire supply of hot water at the sterilizing temperature of 180 degrees has required the installation of two distinct water heating units, one to supply the required high temperature water for sterilization dish rinsing, either as a direct heater or as a "booster" to raise the temperature of preheated water from another source, and one to supply the hot water required for general use at moderate temperature. Even where hot water at average temperatures of from 130 to 140 degrees has been available from central plants in large buildings, it has still been necessary to employ gas fired equipment to "boost" the water to 180 degrees or other sterilizing temperature. If the demand for 180 degree water were large, the investment and maintenance cost of dual hot water heating equipment would be disproportionate to the benefits obtained.

Taking into consideration the fact that the deposition of lime is approximately 7 times as rapid when a temperature of 180 degrees is maintained in a storage tank than is the case if a temperature of only 140 degrees is maintained, effectively handicaps that type of heater in communities where the municipal water supply may be classified as "hard." Rapid corrosion of non-ferrous tanks due to the liberation of free oxygen in the water at that high temperature is almost equally troublesome where the water supply may be classified as "soft." Installation of a storage tank of sufficient capacity to eliminate the possibility of a drop in temperature of the 180 degree water at the point of use, if the demand during any given period of time is greatly in excess of the heaters rate of recovery of 180 degree water, presents the dual problem of investment and restriction of space as the unit must be installed as close as possible to the point of use to eliminate temperature loss in transmission and minimize the liming problem in the piping.

The makers of the Burkay volume-flow water heater developed the booster-recovery installation to meet the demand of commercial dish washing equipment for hot water at sterilizing temperatures for dish rinsing as well as to supply the hot water required at moderate temperatures for other purposes. The heater will, without alteration or change, operate as satisfactorily and efficiently as a "booster" to raise the temperature of water which has been preheated to 130 or 140 degrees as it will operate in conventional service. This enables the heater to function in the dual capacity of preheating the reserve supply of water for general use and when required, "boosting" the preheated water to higher, sterilizing temperatures wherever preheated water is not already available from central plants in large buildings or other similar sources. The rate of flow volume of 180 degree water which will be available per minute under such circumstances wil be practically three times as large as could be secured were preheated water not available and the temperature of the inlet water were to drop to as low as 40 degrees.

In the operation of mechanical dish washing equipment the demand



for sterilizing temperature rinse water is only intermittent and but comparatively few seconds are required for each dish rinsing interval or cycle. This demand being intermittent, the heater would be required to operate only during a part of each hour to supply even the peak demand for sterilizing rinse water during any given hour and would stand idle during the remaining time.

The Burkay booster-recovery installation employs this otherwise idle heater time in preheating a dependable storage reserve of water to a temperature of 130 to 140 degrees F. The availability of this dependable reserve of preheated water which, when required for dish rinsing, need be "boosted" only 40 or 50 degrees to reach sterilizing temperature, enables the heater to supply this required sterilizing rinse water at a rate of flow as high as seven and one-half gallons per minute which is adequate to meet the intermittent rinse water demands of all but the largest sizes of mechanical dish washing equipment.

The over-all efficiency of the single installation operating more nearly full time to supply the demand for hot water at dual temperatures will be much greater than would be possible were two units to each operate only part time in dividing the same job. This fact alone will answer the objection to high operating costs.

The illustration shows the plan of installation in the Liggett's Drug Store, Springfield, Mass.

The heater itself is 40 inches high, weighs 108 pounds and, at its full rated gas input of 190,000 B.T.U.'s per hour, will supply hot water at the rate of 5.2 gallons per minute at a 60 degree temperature rise.

The installation employs a storage tank and a standard motor driven circulating pump commonly used in hot water heating systems. An aquastat installed in the tank controls the action of the pump motor and the rapidly accelerated flow of water induced by the circulating pump through the heater during the "Recovery" cycle of operation, enables it to utilize practically the full rated input of gas for quickly replacing the water drawn from the tank during the time in which the heater is not called upon to operate in supplying 180 degree water.

Complete details covering the Burkay heater and its performance, as well as an outline of a sales promotion program may be obtained from The Burkay Company, 2003 Ohio Building, Toledo, Ohio.

How Much Will Any I-Beam Hold?

by

W. F. Schaphorst, M.E.

Newark, N. J.

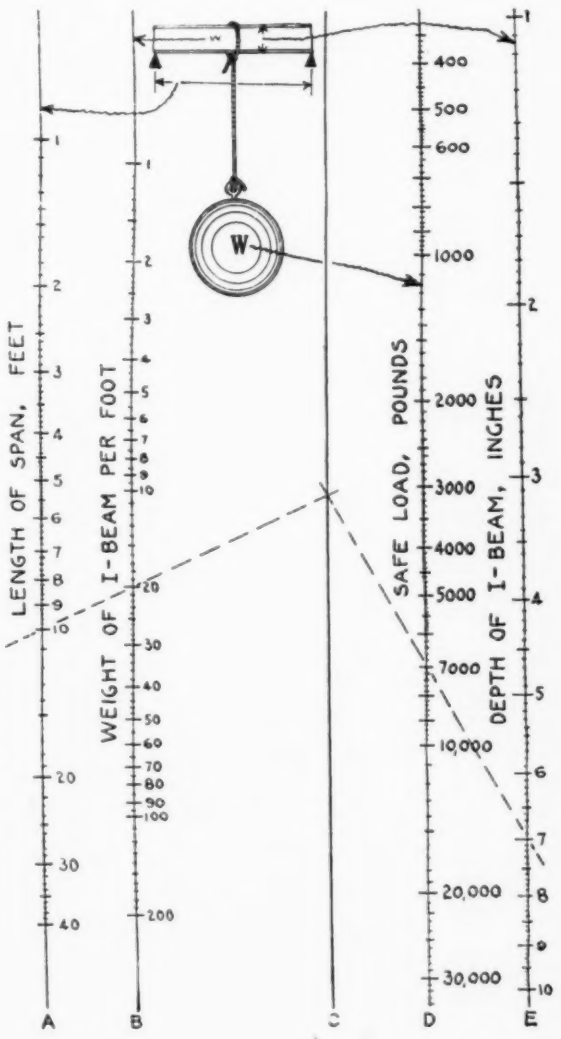
This chart answers the above question. No computations are necessary. The chart tells how much any ordinary I-Beam will hold under the very *worst* condition, with the load concentrated in the middle of the span as shown by the sketch on the chart. The chart is based on concentrated loading for the sake of safety.

Let us suppose that a weight of 4,000 lbs. must be supported. A 7-inch I-Beam, weighing 240 lbs., is available. It is 12 feet long, and therefore weighs 20 lbs. per foot. The minimum distance between supports that can be obtained for the lifting operation is 10 feet. Is the I-Beam strong enough to lift the 4,000-lb. load?

The dotted lines drawn across the chart show how the problem is solved. Run a straight line through the 10-ft. (column A) and the 20-lb. (column B), and locate the intersection in column C. Then, from that intersection in column C, run over to the 7-in. (column E). The intersection through column D shows that the I-Beam will support 7000 lbs. Since the load to be lifted is only 4000 lbs., the beam is amply strong. In fact, the reader can easily find, by applying the chart, that a 4-inch I-Beam, all other conditions being the same, would safely support the load of 4000 lbs.

Similarly, it is easy to ascertain the maximum allowable span when the factors in columns B, D and E are known. Or, the necessary weight per foot of I-Beam may be determined when the factors in columns A, D and E are known. Lastly, the depth of beam is determinable when the factors in columns A, B and D are known.

For loads that are "uniformly distributed" — not concentrated — the safe loads in column D may be multiplied by two. Thus, the above described beam will support a uniformly distributed load of 14,000 lbs., or 1400 lbs. per running foot.



New Equipment and Appliances

Improved Calorimeter

An automatic watchman that keeps the product of gas plants up to the required heat value standard and which calls for help if anything goes wrong is an improved Calorimeter known as the Caloroptic, made by Connelly Iron Sponge and Governor Company, 3154 South California Avenue, Chicago.

The instrument can be installed in permanent position and is valuable in mixed gas plants or propane-butane-air gas systems, as well as in regular manufactured-gas plants.

The Caloroptic

When setting the Caloroptic to provide a constant indication of the increase or decrease in B.T.U. content of the gas, the air port is adjusted so as to provide some yellow in the flame to actuate the cell, which in turn is connected to and operates an extremely sensitive electric relay, which operates red and white lights to indicate at a distance the condition of the gas. The relays can also be connected to a horn or a bell to call the operator's attention to B.T.U. changes.

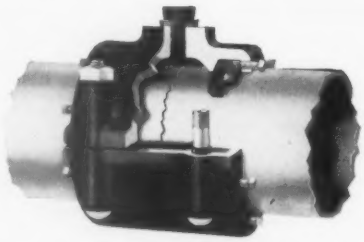
The Caloroptic can also be carried about handily to take spot readings. A new illustrated bulletin fully describes the device.

New Repair and Tapping Sleeve

Dresser Manufacturing Company of Bradford, Pa., offer their new "Ready-Pack Sleeve, Style 80," as a means of effecting greater economies in quick, permanent repair of breaks, splits, and holes in the straight run of cast-iron pipe.

This new sleeve is intended for nominal CIP sizes 3", 4", and 6". Each nominal size is said to fit variations in the actual pipe OD within a quarter-inch range, this "take-up" thus providing a seal on off-size pipe.

While the most conspicious feature of the new style-80 sleeve is the fact that it reaches the user ready-assembled, thus permitting installation by one man in 5 to 10 minutes,



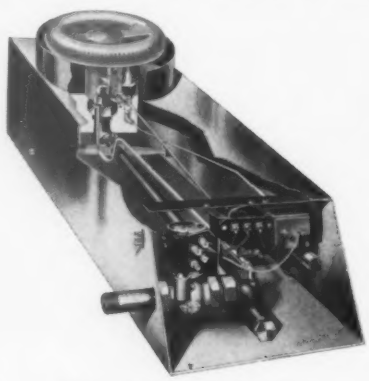
Dresser Ready-Pack Sleeve

the low price is also emphasized by the maker. Style 80 is said to be priced 30% to 40% lower, and to compare favorably with the installed cost of foundry "splits."

Another important feature stressed by the manufacturer is the use of this sleeve as a service or tapping sleeve. Where a break has occurred at a service connection, no new tap in main is necessary. The service line is simply reconnected into the vent of the sleeve; vents are available in standard diameters up to and including 3". The sleeve is also recommended for initial use in making service connections.

Conversion Burner

An automatic electric ignition conversion burner is announced by the Johnson Gas Appliance Co. of Cedar Rapids, Iowa. Designed for operation on either natural or manufactured gas, it eliminates costly service calls.



Johnson Conversion Burner

In addition, it gives the customer the benefit of 12 months heating service by simply flicking the thermostat—yet eliminates the constantly burning pilot light, and is quickly and easily installed.

The electric ignition is available as an auxiliary unit adaptable for furnaces, conversion burners, floor furnaces, gas ranges and water heaters.

Illustrations and description of this burner and other Johnson Gas products are found in a new catalog.

Basmor Air Conditioner

The Basmor Gas Fired Warm Air Conditioners are made in 3 types and 8 capacities, these units being adaptable to any type of installation. Forced circulation makes it possible to install the unit on the same level or even in the attic above the space to be conditioned.

Humidification, forced circulation, and air filtration together with its highly efficient operation makes this equipment practical for low cost homes, commercial, and industrial uses.

Basmor Hi-Model

Their development is the result of the experience gained in more than a quarter of a century in the manufacture of gas fired heating equipment.

Information may be had through the nearest Crane Co. office or Bastian-Morley Co., Inc., LaPorte, Indiana.

TWO YEARS for $3.00

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1940 Edition of American Gas Catalog & Handbook

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Enter my subscription to American Gas Journal for Two years to include a copy of 1940 Edition of American Gas Catalog and Handbook to be issued April 1st 1940. I will remit $3.00 on receipt of invoice. Handbook is included with subscription for one year ar $2.00. Indicate whether one year or two year subscription is desired. ☐ Two years. ☐ One year.

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(Rates quoted for United States only)

framing. Price 80 cents each, plus mailing.

Another way to localize the campaign is to use reprints for mailing to new range prospects, for distribution to cooking classes, for salesroom and home service giveaway, etc. Price $13.00 per thousand, plus mailing.

Through the courtesy of A. G. Schroeder, assistant general manager of the Michigan Consolidated Gas Company at Grand Rapids, the Association also offers for general use of the gas industry an attractive four-color booklet "Your Personalized All-Gas Kitchen."

It is a colorful, practical booklet on good kitchen design incorporating some pointed references to the superior operating efficiencies of modern gas appliances, particularly CP ranges. The price scale ranges from 15c each in 1,000 lots down to 5c in 25,000 lots including imprinting of Company name and address on the second page. Obtainable from The James Bayne Co., Grand Rapids, Mich.

Penna. Natural Gas Men's Assn.

The November dinner meeting of Pennsylvania Natural Gas Men's Association was held on November 27, at the Pittsburgh Athletic Association, Oakland, Pittsburgh, Pennsylvania.

"Increasing Dealer Interest in Gas Appliances" was the subject for discussion. The speakers were Mr. Emil Hofsoos, Vice-President of Ketchum, MacLeod & Grove, Inc., and Mr. Louis F. Demmler, Director, Gas Appliance Promotion Division, of the same Company.

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Officers are: W. H. Haupt, President; Geo. Wittmer, Jr., Vice-President; B. H. Smyers, Jr., Secretary-Treasurer and Mark Shields, Executive Secretary, Grant Bldg., Pittsburgh, Pa.

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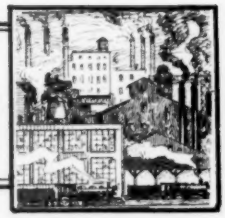

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The Brooklyn Union Gas Company reports that their delivered sales of gas appliances for the first ten months of this year is approximately $3,336,500, or 22.6% above the corresponding period of 1938.

Their current year's sales for this same period are over $150,000 greater than sales for the corresponding period of 1937, which was their banner year. Continuation for the balance of the year at the present rate indicates that 1939 will set an all-time record.

The Gas Service Company of Kansas City reports that sales and installations in October of this year were $23,600 ahead of October, 1938, in which year total sales in that month amounted to $247,140.

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An automatic watchman keeps the product of gas pla to the required heat value sta and which calls for help i thing goes wrong is an imp Calorimeter known as the Co tic, made by Connelly Iron S and Governor Company South California Avenue, Ch

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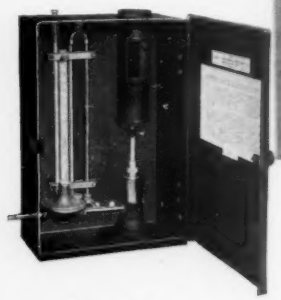

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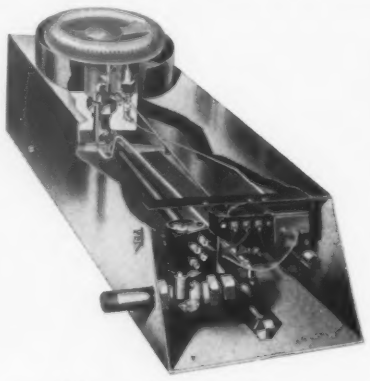

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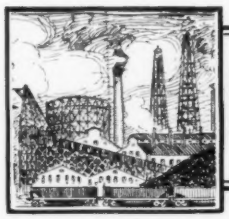

News of the Gas Industry

A.G.A. National Advertising

Bulletins issued by the A.G.A. Committee on National Advertising on November 24th call attention to the third of seven four-color, full-page advertisements scheduled for national magazines during 1939-40. The main illustration incorporates the latest innovations in colorful kitchen decoration, and the text strongly emphasizes the superior performance characteristics of modern gas ranges.

This advertisement enlarged to a size 24"x30", and in four colors, is for display on the sales floor, in show windows or other advantageous spots. It is ready for wall hanging, easy mounting or framing. Price 80 cents each, plus mailing.

Another way to localize the campaign is to use reprints for mailing to new range prospects, for distribution to cooking classes, for salesroom and home service giveaway, etc. Price $13.00 per thousand, plus mailing.

Through the courtesy of A. G. Schroeder, assistant general manager of the Michigan Consolidated Gas Company at Grand Rapids, the Association also offers for general use of the gas industry an attractive four-color booklet "Your Personalized All-Gas Kitchen."

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EMCO Sponsors Employees Course in Gas Engineering

A course of instruction in the fundamental sciences necessary to the natural gas industry has been inaugurated by the Pittsburgh Equitable Meter Company, of Pittsburgh, Pa., for their employees. The course is under the supervision of the Extension Division, Pennsylvania State College.

At present, sixty men have enrolled and are meeting once each week. Covering a two year period, instruction will consist of a review of arithmetic, algebra, chemistry and physics during the first year, while in the second year the course will be devoted to the problems connected with the production, transmission, regulation, measurement and utilization of natural gas. At the end of this second year, each man will receive a certificate of completion.

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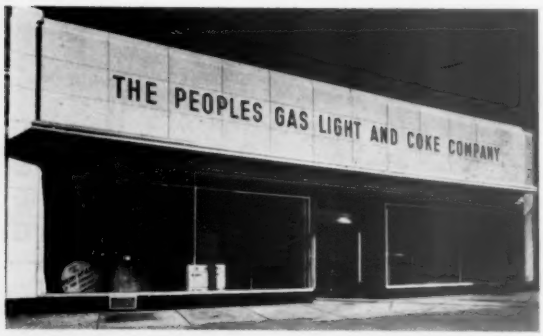
Attractive Store Front in Chicago

Am I giving myself and my business a chance for success? Is my store front something to be ashamed of, or a merchandising asset? Is it smart merchandising for me to spend money on equipment and salaries and neglect or fail to appreciate the power of store front advertising?



Store front installed by General Porcelain Enamel and Mfg. Co., Chicago.

These are important questions that every retail store owner must answer.

That the People's Gas Light and Coke Company has considered these questions is indicated by the beautiful new store front installed on their retail outlet recently at 4829 South Ashland Avenue, Chicago, Ill. Says Mr. Harry Swenson, Director of Displays, of the Company:

"The porcelain enameled store front installed recently on our building stands out above that of any in our neighborhood. It invites the attention of traffic by its white, clean and distinctive design. Its tailored lines give the store a modern, businesslike appearance. The passerby finds his eye drawn to its colorful design, which forms a beautiful frame for the merchandise on display."

The store front here pictured is of porcelain enamel stippled ivory background with burgundy lettering.

Porcelain Enamel Institute Elects Officers

P. B. McBride of the Porcelain Metals Corp., Louisville, was elected president of the Porcelain Enamel Institute for 1940 at the organization's Ninth Annual Meeting in New York City November 16 and 17. Mr. McBride, whose plant is one of the most modern in the South, is well qualified for the office by his leadership in bringing about many of the innovations in the porcelain enamel industry in recent years.

Wm. H. Brett, Enamel Products Co., Cleveland, O., and R. R. Danielson, Metal & Thermit Corp., Carteret, N. J., were named vice-presidents. William Hogenson, Chicago Vitreous Enamel Product Co., Cicero, Ill., was re-elected treasurer, and C. S. Pearce, Chicago, retains the position of managing director.

One of the most stimulating programs in recent years provided the enamelers with many interesting new slants on sales promotion, development problems, and color and design engineering.

Sales on the Up Grade

Pacific Coast gas sales are up 14.0 per cent for the first 8 months, customers up 3.5 per cent and revenue up 4.9 per cent, this last in the face of general rate reductions. These percentages should be bettered later, as the year got off to a slow start. National Gas Range sales are up 34.2 per cent and nearly 11 per cent of all heat controlled ranges sold bear the CP insignia. Water heater sales are up 30 per cent; boilers up 13.6 per cent; furnaces up 70.1 per cent; and conversion burners, up 53.0 per cent.

Coppus Appointments

The Coppus Engineering Corporation, Worcester, Mass., announces the appointment of the following new district representatives:

Rees V. Downs, 422 Exchange Bldg., Memphis, Tenn.

Hughes Machinery Co., 342 Manufacturers Exchange Bldg., Kansas City, Mo.

L. D. McKay, 533 Mayo Bldg., Tulsa, Okla.

These names have been added to strengthen the sales organization of this Corporation which recently has put on the market the Coppus-Dennis Fanmix Gas Burner, a rotary type gas and combination gas and oil burner for industrial and refinery applications.

Steiner-Ives Co. in Larger Quarters

Steiner-Ives Co., manufacturers of "Zephyr" ovens for the baking industry and Steiner ovens for the industrial field on a larger scale, formerly located at Bloomfield, N. J., announce their removal to larger quarters at 14-16 Avenue L., Newark, N. J. V. C. Kylberg continues in the capacity of sales manager of the organization.

Colored Maids Instructed In Use of Appliances

The Central Florida Gas Corporation has finished a series of five weeks instruction to colored maids in the use of their appliances. For their final meeting the services of Mrs. Thelma Brown, home economics director for the Florida Power and Light Company, Lakeland division, was secured. Mrs. Brown's ability to impress her audience is well known throughout the state.

At the Central Florida gas office she cooked a complete meal giving instructions as she progressed and served it to 15 colored maids of Bartow.

The object of this work is to fit the maids for better service in the homes.

This series of meetings has been developed by Joe Taylor, local manager of the Central Florida Gas Corporation.

Another class will be formed in January starting right after the new year.

To those girls who have been to all lectures a diploma was issued stating their ability to carry on and that they had given close attention to all lectures.

Miss Esta Whidden, of the office force assisted Mrs. Brown.

Colored maids of Bartow, Florida, smile in anticipation of diplomas that await them. Their sponsors stand in the background.

Ginn Chairman on CP Sales

Lloyd C. Ginn, sales promotion manager of the American Stove Co., Cleveland, Ohio, who has accepted the chairmanship of the CP Sales Management Committee of the Domestic Gas Range Division of the Association of Gas Appliance and Equipment Manufacturers and who will direct 1940 sales promotion of CP Gas Ranges.

Lloyd C. Ginn

It is estimated that utilities, dealers and range manufacturers will spend close to one million dollars promoting the modern gas range next year.

Air Conditioning

"Uses of Air Conditioning" is covered in a report of Industrial Training Institute, of Chicago. Listed as Study No. 63, this copyrighted report presents a survey of facts and lists 355 applications of air conditioning alphabetically listed under various industries. The functions of the report are (1), to broaden the market potential for sales executives in air conditioning and (2), to indicate the extent to which air conditioning has invaded every phase of modern life.

Offices of the Institute are at 2130 Lawrence Ave.; Ray D. Smith is President.

Sprague Meter Co. V.P.

E. H. Roseberry who was elected Vice President of Sprague Meter Company of Bridgeport, Conn., at a meeting of their Board of Directors in October. He will continue to maintain his office at Los Angeles where he formerly served as Branch Manager.

Bullock Photo

Clock a Premium in Range Campaign. Thermostats for Heater Sales

The companies in Southern California including Los Angeles and San Diego have completed another successful range campaign in which the clock was used as a premium. San Diego dealers engaged in a space heating campaign emphasizing floor furnaces and circulators. Buying urge is a free thermostat. All installations are inspected by the gas company which supplies the thermostats. In support of the campaign the company has published a booklet entitled Q.E.D. It illustrates and describes the proper method of heating with floor furnaces and circulators and follows this up with twenty-odd cases of satisfied users. For each case there is a picture of the house, a statement by the customer, and the amount of gas bills by months for the past twelve months. This proves graphically and convincingly the low cost of gas heating in San Diego. The book is being distributed through dealers and by company employees.

New Worthington Officers

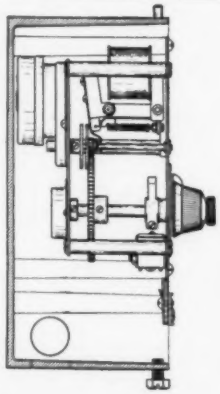
The election of Mr. Maynard D. Church as vice-president of Worthington Pump and Machinery Corporation is announced by Mr. H. C. Beaver, the corporation's president.

Mr. Church is also president of the Moore Steam Turbine Corporation, Wellsville, New York, which has been for some time a Worthington subsidiary, and he will continue to be in charge of Moore operations.

Upon his graduation from Syracuse University in 1906, Mr. Church joined the Kerr Turbine Company of Wellsville, which he left in 1913 to become vice-president and chief engineer of Dayton Turbine Pump Company. From 1915 to 1924 he served as Chief Engineer of Terry Steam Turbine Company, and in 1924 became General Manager of Moore Steam Turbine Corporation. He was elected president later that year.

Maynard D. Church

The election of Mr. R. W. Towne as Assistant Secretary of Worthington is also announced by Mr. Beaver. A graduate of Cornell University, in 1924, Mr. Towne immediately joined the Moore organization, becoming secretary and assistant treasurer in 1936.



Partlow Time Delay Relay

The diagram shows the operating principle of Model 308 Time Delay Relay. It is used for automatically timing the duration of a process cycle.

A synchronous timing motor drives a gear train through a magnetically engaged clutch. At the end of the timing period, a switch operates to stop the timing motor and either connects or disconnects the load as desired. When the timer circuit is broken the magnetic clutch releases, and the time automatically resets itself.

The time range is adjustable by setting the knob with pointer to the desired time on a calibrated scale.

Three timing ranges are available in all Models: 0 to 5 min., 0 to 15 min., 0 to 50 min., or 0 to 5 hours.

The relay is entirely enclosed in black ripple finish aluminum case with glass window or open-faced cover for observation of the dial. Four knockouts are provided for convenient wiring.

Ask for Bulletin 770.

PARTLOW

The Partlow Corporation

2 Campion Road, New Hartford, N. Y.

Offices in Principal Cities

Gas Home Heating Campaign

During the month of September, 1939, The Bryant Heater Co. conducted a contest on a national basis to promote the sale of gas heating to existing and occupied homes. This was called the "Make September Deliver" contest.

On the week-end of November 3 and 4, the prize winners of this contest were announced, the three top men in the natural gas division, the three top men in the manufactured gas division, the three top men in the mixed gas division, and one who won a special award.

The Winnahs

Seated—left to right:
R. M. Peak
G. Temple
M. O. Hilborn
S. B. Morse
R. S. White

Standing—left to right:
E. J. Lundgren
G. E. Evanshaw
L. L. Shiley
T. E. Pekelder
H. T. Sherwood

The winners were as follows:

Manufactured Gas Group: First Place, Samuel B. Morse, Westchester Lighting Company; Second Place, Herbert T. Sherwood, Westchester Lighting Company; Third, Place, L. L. Shiley, Portland Gas & Coke Company.

Mixed Gas Group: First Place, G. Temple, Washington Gas Light Company; Second Place, G. E. Evanshaw, Washington Gas Light Company; Third Place, R. M. Peak, Washington Gas Light Company.

Natural Gas Group: First Place, T. E. Pekelder, Michigan Consolidated Gas Company, Grand Rapids; Second Place, M. O. Hilborn, Michigan Consolidated Gas Company, Grand Rapids; Third Place, R. S. White, Cedar Rapids Gas Company.

Special Award: E. J. Lundgren, Minneapolis Gas Light Company.

The basis of these awards was made the number of points earned by the salesmen for the sale of boilers, furnaces, or conversion burners to occupied and existing homes in the month of September. Points were awarded regardless of the make of equipment, which made the contest a truly industry contest on a national basis.

There were 455 salesmen enrolled in the contest from fifty-eight companies in a hundred twenty-eight different cities. On a basis of the sales reported, more than a quarter of a million dollars of net added annual gas load was put on the lines by these men in the one month of September in existing homes. This of course meant that no main extensions or other capital expenditures were necessary to get this additional load.

The ten men, on November 3 spent the entire morning in going through the Bryant factory to see how the equipment was made. At a luncheon, the prizes, gold wrist watches, were presented to each of the winners by Lyle C. Harvey, President of The Bryant Heater Company. Then, the men made a trip of inspection through the American Gas Association Testing Laboratory as the guests of Mr. R. M. Conner. After the dinner they attended a theatre party at the Hanna Theatre and on Saturday morning, were taken to Columbus to see the Ohio State-Indiana football game.

CURRAN-KNOWLES
GAS AND COKE OVENS

Successfully carbonize Low Volatile, High Volatile, Swelling or Non-Swelling Coals.

Give a high yield of superior quality coke for water gas generator fuel, industrial and domestic use; a high yield of tar of excellent quality and a uniform quality of gas which meets Commission requirements.

Top of Ovens Curran-Knowles Plant in British Columbia, Canada, where low volatile expanding coal is carbonized.

Substantial construction. Low initial cost per M. capacity. Low operating cost due to simplicity of design.

Built to suit any situation. Over 5 years' successful operation.

Ask for bulletins showing plants and products.

COAL CARBONIZING CO.

Bank of Commerce Bldg. St. Louis, Mo.

Stimulate Water Heater Sales

HOUSEHOLD GAS WATER HEATING

By Charles W. Merriam, Jr.

Nine chapters of the true essence of this subject.

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Engineering ABC's
Water Heater Types
Hot Water—How Much?
Gas Consumption for Water Heating
Water Piping & Installation
What Size Heater
Automatic Heater Accessories
Competitive Water Heating
Hot Water—For What?

"A Book like this has long been needed to enable our salesmen to present a sound and convincing attack on this most worthwhile business of our industry."—A. M. Beebee, Gen. Supt. Gas Dept., Rochester G & E Co., Rochester, N. Y.

"A Real contribution to the gas industry."—R. A. Koehler, Chairman, A.G.A. Water Heating Committee.

Size 5" x 8", 142 Pages amply illustrated. Cloth Bound. Special Close-Out Price $1.00 a Copy.

AMERICAN GAS JOURNAL
53 Park Place New York

New Company To Manufacture Heating and Air Conditioning Equipment

A new company known as The C. A. Olsen Manufacturing Company has just been organized with headquarters at Elyria, Ohio.

The company has acquired a large plant at Elyria owned by The American Rolling Mills Company of Middletown, Ohio. The plant is being modernized and renovated.

The company will manufacture gravity warm air furnaces, winter air conditioning units for gas, oil and coal and blower units.

C. A. Olsen who heads the company has been active in the industry for many years as President of The Fox Furnace Company, Elyria, Ohio, a subsidiary of the American Radiator and Standard Sanitary Corp., and as Vice-President

Almon Chapin

E. C. Carlson

of The National Warm Air Heating and Air Conditioning Association. His keen interest in the research activities of the Association, and in industry development work, has contributed in no small degree to improved conditions.

E. C. Carlson has been appointed Secretary and Treasurer of the new company. Mr. Carlson was for many years associated with the Lennox Furnace Company of Marshalltown, Iowa and later served as General Manager of the Armstrong Furnace Company of Columbus, Ohio.

Almon Chapin has been appointed Production Manager of the new company. Mr. Chapin was for several years associated with The Fox Furnace Company on production, research and development work.

The new company will use the trade name "Luxaire" on all of its products.

Worthington District Office in Tulsa, Okla.

Beginning December 1, 1939, the business heretofore carried on by Worthington Machinery Corporation of Oklahoma at 424 North Boulder Street, Tulsa, Oklahoma, will be taken over direct by Worthington Pump and Machinery Corporation as its district office at the same address. The district manager will be J. O. Lewis, already well-known in this territory.

Worthington Machinery Corporation of Oklahoma will remain in existence for the present to settle current business and to collect its outstanding accounts.

C. A. Olsen

Mueffels with Reynolds Regulator

Reynolds Gas Regulator Company announce the appointment of H. Mike Meuffels as Sales Engineer in charge of the Mid-West office at Kansas City. Mr. Meuffels has enjoyed a wide experience in the natural gas field. He has written numerous articles on Butane-Air Standby Plants and Control of High Pressure Gas.

Mr. Meuffels secured his engineering education at Kansas University, which he completed in 1922. He was employed by the Empire Oil and Refining Company of Bartlesville, Oklahoma, in the Gasoline Division from 1922 until 1925 and from 1925 until 1928 was geologist and field engineer for this company.

Kansas City Offices of the Reynolds Gas Regulator Company are in the Dwight Building.

INDUSTRIAL GAS BOILERS
GARMENT PRESS BOILERS
100 lbs. ASME Code
¾ to 45 H.P.

P. M. LATTNER MFG. CO.
MAIN OFFICE
CEDAR RAPIDS, IOWA

H. M. Meuffels

Effects of Cyanogen

(Continued from page 13)

3. Hydrogen sulphide and iodine yield hydriodic acid and sulphur. This reaction is irreversible under the conditions of this method.
4. No other constituent in the gas has been found which absorbs iodine in sodium bicarbonate solution and then liberates iodine upon acidification of the products of absorption.

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Book Review

Handbook of Chemistry and Physics. Chemical Rubber Publishing Company, Cleveland, Ohio. 23rd Edition. Size 7⅛x4¾, 2239 pages. Regular Edition $3.50, Deluxe Edition $6.00.

This book contains a wealth of information for the gas man. Although some of the chemical tables, formulae, etc. are of limited interest to industrial gas men, the tables and information covering physical properties of elements and compounds comprising the breakdown of items of mathematical tables, physical constants, specific gravity, properties of matter and heat contain many items particularly pertinent in industrial gas practice.

This handbook should be in the operating files of every industrial gas engineer. It is broad as to items covered, concise, yet thorough as to information given, containing a wealth of information in table form.

Catalogs

"Instruments for Oil and Gas Production", an 11-page illustrated bulletin just issued by The Foxboro Company, Foxboro, Mass., describes Foxboro methods of instrumentation in the production and refining industries.

Each instrument in the line is treated individually; operating and construction details for each instrument are supplemented by illustrations and standard specifications. Typical installation photographs are also included.

Among the instruments discussed in the bulletin are the orifice meter, portable meter, recording gauges, portable gauge, indicating gauges, test gauges and recording thermometers. Copies of this bulletin, No. 238, may be obtained by writing The Foxboro Company, Foxboro, Mass.

Turbine Pumps. Bulletin 260-B11D issued by the Turbine Pump Division of the Roots-Connersville Blower Corp., covers industrial applications. These pumps are offered in three types of construction: bronze-fitted, all-iron, and all-bronze; and are designed for handling liquids at temperatures up to 210° Fahr. Capacities range up to 185 GPM, at heads up to 600 ft., without multi-staging.

Design features are shown in detail, including a cutaway view of the pump, diagram of the internal seals, typical performance curve, and standard specifications.

Material Handling. A bulletin issued by Elwell-Parker Electric Co. of Cleveland describes their Scoop Trucks for handling loose materials such as stoker coal, dry chemicals, fertilizers, ammonium sulphate and superphosphates, salts, soda ash, etc.

Portable Pipe Threader. Bulletin B of Beaver Pipe Tools, Inc., Warren Ohio, describes their model B and C portable pipe and bolt threaders, power driven, for pipe diameters from ⅛ to 8 inches. Copy sent on request.

Repair Sleeves. Dresser "Ready-Pack" sleeves, style 80, are described in Bulletin 395A issued by Dresser Mfg. Co., Bradford, Pa. Their use as a service or tapping sleeve are shown in considerable detail.

Zinc Dust Paints. Volume I No. 1 of "Paint Progress" issued by The New Jersey Zinc Co., 160 Front Street, New York, stresses the fire and corrosion resisting qualities of their products. Copy sent on request.

Air Conditioning. Trane Co., La Crosse, Wis., issue bulletin S347 featuring various types of gas units for air conditioning in the home and for commercial purposes. Details of the units are well illustrated.

Potentiometer Recording Pyrometers. A 15-page illustrated booklet just issued, provides complete data on Foxboro instruments for use in recording of industrial temperatures. A cutaway view of the potentiometer recorder gives a concise picture of the simplicity of design and accessibility of the instrument. Similar views, together with descriptive text, fully illustrate the various details.

Copies of this bulletin, 190-3, may be obtained by writing The Foxboro Company, Foxboro, Mass.

Utility Fittings. Catalog 40-G just issued by Eastman Manufacturing Co., Manitowoc, Wis., describes their complete line of gas appliance fittings and connectors. Dimensions and prices are included. A carrying capacity chart for copper and aluminum semi-rigid tubing is appended.

Turbine Well Pumps. A new line of Turbine Well Pumps is announced by the Worthington Pump and Machinery Corporation of Harrison, New Jersey. For use in bored wells, these new units feature vacuum molded impellers—the first time this construction has been used in this type of pumping equipment.

Important details of construction are illustrated in their bulletin H-450-B29. A companion bulletin, H-450-B30, deals particularly with the vacuum molded impellers used in these pumps.

The Airco No. 10 Planograph, a new 4-page bulletin describes this gas-operated cutting machine designed for cutting straight lines, rectangles, circles and irregular shapes from ferrous metal of any thickness within the present practical limits of the cutting torch. Copies may be obtained by writing Air Reduction Sales Company, 60 East 42nd Street, New York, N. Y.

Safety Appliances. A 32-page catalog, Number 600, featuring new and improved types of Pop Safety and Relief Valves and Gauges for the oil, gas and general industrial field is issued by J. E. Lonergan Co., 211 Race St., Philadelphia, Pa.

It shows advanced and specially designed safety appliances. Among them are Relief Valves designed for extremely high pressures and temperatures prevalent in oil cracking systems, and improved model of a steel Pop Safety Valve for oil field boiler service and a high pressure relief valve with either a monel or stainless steel seat for oil and gas service. A phenol case refinery gauge is one of the further new products fully described.

This catalog is profusely illustrated and contains helpful engineering information such as discharge capacities, maximum temperature and pressure ratings as well as capacity and temperature conversion factors.

Pyrometers. A new illustrated bulletin fully describing Hold-Heet Pyrometers has just been released and will be sent free of charge to any firm writing this publication or Russell Electric Company, 343 West Huron Street, Chicago. Some of the uses are for checking the temperatures of tin, lead, solder, babbit, type metal, spelter, and brass, also for checking high surface temperatures of billets, slabs, heated rollers, forgings and the like, as well as for ovens, hot-plates, heating elements, etc.

Gas Exhausters and Boosters. The Roots-Connersville Blower Corporation has issued a 20-page bulletin No. 32-33-B-11, illustrating and describing their rotary positive gas exhausters and boosters. Pressure-volume curves and information regarding operating characteristics of this equipment are given.

These exhausters and boosters are extensively used in producer, manufactured, and coke oven gas plants, for boosting gas on distribution systems, in chemical manufacturing processes, in the manufacture of explosives and in sulphuric acid plants, for handling vapors in oil refineries, pumping natural gas to compressors, boosting gas pressures to burners, and wherever gases have to be moved under moderate pressures. Exhausters and boosters in various arrangements for motor, gas engine and steam engine drive are illustrated.

Copies of this bulletin are available and will be gladly mailed upon request.

Gas Burners and Equipment. New 16 page catalog issued by Johnson Gas Appliance Co. of Cedar Rapids, Iowa, shows their full line of burners, furnaces and torches. Well illustrated together with details of dimensions and capacities. Copy on request.

Electric Arc Welders. Dedicated to the "Man in the Helmet", the Wilson Hornet bulletin describes a revolutionary new electric arc welding generator. This 18-page bulletin is profusely illustrated with photographs for clear-cut definition of operating and construction details of this essential piece of welding equipment.

Copies of this bulletin may be obtained by writing Wilson Welder and Metals Company, 60 East 42nd Street, New York, N. Y.

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Coal Gas Plants—Horizontal Ovens, Benches, Refills, Additions, Repairs, Charging and Discharging Machines.

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Oil Gas Plants—"Refractory Screen" Process for Base—Standby or Peak Loads — On Existing or New Water Gas Sets—Low or High B.T.U. Gas.

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RIGHT ON THE BOARDWALK

FROM WITH MEALS & BATH $6
$3 ROOM ONLY & BATH
Per Person 2 in a Room Less Weekly

Here you will find everything to further your comfort and enjoyment — outside ocean-view rooms . . . sun deck . . . beautiful dining room at the ocean's edge . . . superb cuisine . . . varied sports . . . and entertainment. You'll like your fellow guests . . . and the delightfully friendly atmosphere of The Chelsea.

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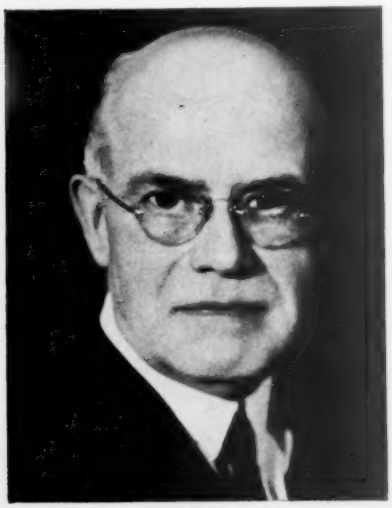
TANKS, BINS, FLUES PURIFIERS, WELDINGS

Obituary

PAUL HERRING

Paul W. Herring, Director of Employe Relations for the Peoples Gas Light and Coke Co., died suddenly at his home in Glen Ellyn, on Saturday, October 21.

Mr. Herring began his 31-year business career with the company in October, 1908, as an Assistant Timekeeper in the main office of the old distribution department.



Paul W. Herring

He was later promoted to chief clerk in that department, in which capacity he introduced the use of the comptometer for payroll work. During subsequent years he organized the company's payroll and stores accounting departments, and inaugurated a merit system for standardizing transfers and promotions of employes. Two president's training courses, naturalization classes and other training activities were conducted under his jurisdiction.

In 1919, Mr. Herring organized the company's employment department, and in 1924 was named assistant to the vice president in charge of public and industrial relations. In August, 1937, he was appointed director of employe relations, the position he held at the time of his death. Mr. Herring was active in the American Gas Association's Committee on Personnel Practices during 1937, 1938, and 1939, and chairman during 1938.

The regular functions of the employe relations department, formerly under the direction of Mr. Herring, will temporarily be directed by J. A. Cunningham, secretary of the company.

MONROE HARDING

Monroe Harding, former manager of the Columbus Gas and Power Facilities, died at his home there on Wednesday, October 25th, following an illness of several years. Coming to Columbus from Boston, Mass., in 1912, he had served the gas and power company up to a short time ago when compelled to retire because of failing health. He was, at one time, president of the Columbus Chamber of Commerce.

FLOYD G. CURFMAN

Floyd G. Curfman, vice-president of the Improved Equipment-Russell Engineering, a division of Combustion Utilities Corporation, of 60 Wall Street, New York, died November 5th at his home in Montclair, after a long illness. He was fifty-nine years old.

Mr. Curfman, a native of Malvern, Iowa, was associated with the Henry L. Doherty interests for more than twenty-five years. He was graduated from the Colorado Agricultural College in 1904, after having attended Denver University.

Mr. Curfman was associated with numerous gas engineering companies, including the Denver Engineering Company, George Leyner's Engineering Works, the Improved Equipment Company, Laclede Christy Company and D. R. Russell Engineering Company. He was also in business for himself for a number of years.

© Blanck & Stoller

Floyd G. Curfman

A member of the American Gas Association, Mr. Curfman was also a member of Mountain Lodge of Masons, of Montclair; the Doherty Men's Fraternity and the Guild of Ancient Supplers of Gas Appliances, Skills, Gins, Accessories and Substances, the A.G.A.E.M. and the American Standards Association.

His widow, Mrs. Lillian Grebe Curfman; a daughter, Miss Marilyn Curfman, and a sister, Mrs. Howard Collins, of Denver, survive.

CARL BEHN

Carl Behn, Vice-President of American Bosch Corporation, Springfield, Mass., died on November fifteenth after a brief illness.

Mr. Behn, was widely known throughout the automotive and Diesel industries. He joined the American Bosch organization in 1923 and was made Vice-President in charge of sales in 1938.

Born in Denver, Colorado, October 29, 1896, Mr. Behn received his education in Colorado and Arizona and saw active service in the World War. He was prominently active in various engineering societies and in 1938 was a Vice-President of the Society of Automotive Engineers.

EUGENE METZ

A pioneer among gas meter men of America, Eugene Metz, died November 28th, in Kansas City.

Starting, in 1891, his long association with American Meter Company, Eugene Metz saw unfold before him virtually the entire panoramic development of the modern gas industry and made his own contribution to it. By 1906, he had risen from timekeeper to stockkeeper, and from stockkeeper to purchasing agent of the Metric Metal Works at Erie, and was on his way to represent American Meter Company at Independence, Kan., where an office and warehouse were maintained. Later, he was transferred to Wichita, and subsequently assumed charge of the company's Kansas City office and warehouse.

As Mid-Continent representative for his company, "Gene" Metz's sales territory latterly included Missouri, Kansas, Iowa and Nebraska; but his acquaintance extended from the Mississippi to the Rockies, from Canada to the Gulf—and ran well into other districts as well. He had a generous capacity for friendship, and will be remembered affectionately by a host of friends and acquaintances throughout the industry.

Eugene Metz

Mr. Metz was born in Erie, Pa. in 1868. He was one of the original members of the Natural Gas Association of America, a member of the American Gas Association, The Mid-West Gas Association, The Missouri Utilities Association, and of the Committee of the Southwest Short Course Measurement School of Norman, Oklahoma. Likewise, he was active in all of the Meter Schools at Ames, Iowa. "Gene" would have referred to himself as a plain "gas meter man."

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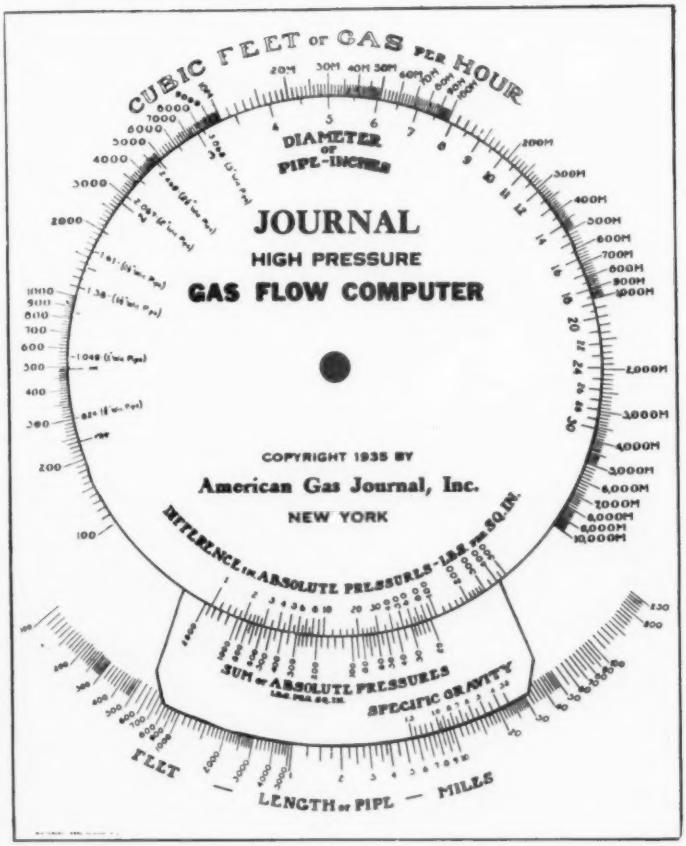

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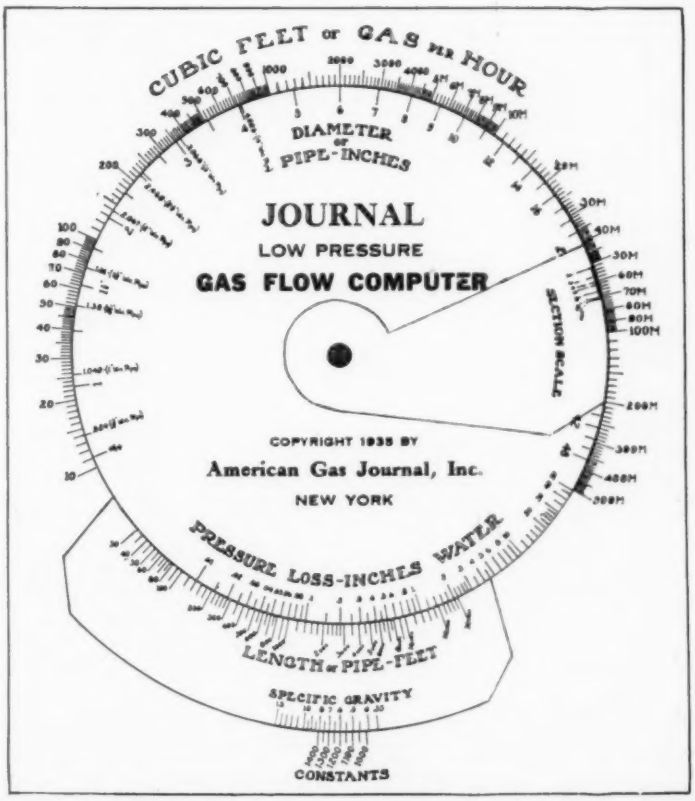

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